Study of *Callistephus chinensis* (L.) in agrometeorological conditions in the southern zone of the Amur Oblast for the prospect of using it in landscaping

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Abstract. The paper presents the results of studying the varieties *Callistephus chinensis* (L.) in the agrometeorological conditions of the south of the Amur Oblast, for the prospect of using annual plants in landscaping. The most promising varieties have been identified.

Keywords: *Callistephus chinensis*, cultivar, weather conditions, decorativeness, resistance

The study of the range of floral and ornamental plants for use in landscaping settlements has recently been the most relevant. Variety study makes it possible to identify the most promising varieties that have a number of decorative qualities that are resistant to weather and climatic conditions of a particular region [1, 2].

One of the most popular ornamental crops in a number of regions of Russia is *Callistephus chinensis* (L.). *Callistephus chinensis* (L.) belongs to the *Asteraceae* family, genus *Callistephus*. The plant is represented by 44 varieties. Currently, there are more than 4000 varieties in the world [3].

Callistephus chinensis (L.) is a herbaceous, upright plant. The stem is green or reddish in color, covered with tough, short hairs. Branching of the main stem begins during budding, sometimes earlier. The most strongly branched tall and dwarf asters, less average [3]. Each shoot ends with one inflorescence. The bulk of the roots is located at a depth of 15–20 cm, some of the roots penetrate into the soil to a depth, so the aster is well supplied with water and nutrients.

Callistephus chinensis (L.) is photophilous, requires open, sunny areas, tolerates light partial shade. Prefers moderate temperature and humidity of air and soil. Seedlings and inflorescences tolerate short-term frosts down to minus 3°C. High temperatures lead to a decrease in terry and worse seed setting. *Callistephus chinensis* is not drought-resistant, requires regular, abundant watering, but excessive moisture and frequent precipitation lead to the defeat of plants by fusarium.

Not picky about fertility, more decorative on light, well-drained, sufficiently fertile, non-acidic soils. During the growing season, the plant needs additional feeding: at the very beginning of flowering and before the formation of buds. In the year of planting, it does not tolerate the

introduction of organic fertilizers.

A very valuable property of *Callistephus chinensis* (L.) is its easy survival rate after transplantation, even in a flowering state. This is due to the fact that damaged roots during planting are easily restored, which allows planting seedlings of various ages, as well as successfully transferring plants to a new place even in the budding and flowering phase [4].

Since this ornamental plant grows well on any soil and tolerates partial shade quite easily, as well as small spring and autumn frosts, it becomes popular in horticulture [5]. Currently, more and more new varieties of *Callistephus chinensis* (L.) appear. Among them are curb low-growing varieties that have earlier flowering periods. From plants, you can compose landscape flower arrangements of long flowering up to 40-60 days. They are also valued for their exceptional durability when cut and used in floristry [6].

In addition to its decorative properties, aster has medicinal properties. Plants contain a huge amount of biologically active substances, flavonoids, coumarins. The plant is actively used in folk medicine as an antipyretic and anti-inflammatory agent, a natural mucolytic [7].

Today, the following is of interest: on the basis of which varieties of *Callistephus chinensis* (L.) can abundant and lush flowering be achieved during the short warm season of the Amur Oblast. Due to the peculiarities of the climatic conditions of the region, primary attention should be paid to drought-resistant and cold-resistant varieties, varieties of the earliest flowering period, which is important in a short summer, and the study of the possibility of obtaining seed in the conditions of the region.

In the Far Eastern region, varieties of some varieties of asters, in particular, low-growing varieties, with an early flowering period appeared relatively recently, with the advent of the achievements of Russian breeding on the basis of domestic agricultural firms. The relevance of the research topic arose from the need to diversify the range of summer houses used for landscaping urban spaces that are most resistant to local agrometeorological factors.

The aim of the research is to study the influence of sowing dates on plant productivity and decorative qualities of *Callistephus chinensis* (L.) cultivars under agrometeorological conditions in the south of the Amur Oblast. The research was carried out at the experimental site in 2019.

Weather conditions in 2019 were extremely difficult and deviated from multi-year data for all observed parameters. The duration of the warm period was 96-99 days, the sums of temperatures deviated from the long-term values downward by 65-130^{o}C. On some days, temperatures dropped to 9^{o}C, absolute maximums were 28-35^{o}C. Precipitation was frequent, with an intense rainstorm, sometimes with hail. During the summer, we celebrated 30-40 days with rain up to 50% more than normal. The dangerous phenomenon of "waterlogging of the soil"

was noted.

The objects of the study were: cultivars Erfurd dwarf, Carpet, Little lady.

The research program included field experience. Phenological observations and biometric measurements of *Callistephus chinensis* (L.) plants, resistance to external environmental factors were noted during the entire growing season. The study was carried out according to generally accepted methods (the method of "Phenological observations in gardens and parks" [8], "Methodology for setting up experiments with fruit, berry and flower-ornamental plants".(1982).

The scientific novelty consisted in the optimal selection of *Callistephus chinensis* (L.) varieties for the climatic conditions of the south of the Amur Oblast.

Plants of the studied varieties were grown by seedlings. The seeds were sown indoors on several dates, in seedling containers on 1 March; March 15, April 2 and April 23. For seedlings, the following composition of the soil mixture was used: 2 parts of garden soil, 1 part of peat, 1 part of coconut substrate.

Plants dived into separate containers in the phase of 1-2 true leaves. Seedling care consisted of watering and loosening the soil. Seedlings were transplanted into the ground in the second half of May on May 23, the layout of plants was 25 x 25 cm. Care for adult plants consisted of loosening, weeding, systematic watering during dry periods.

The summer of 2019 was rainy, therefore, to prevent fusarium infection, they were treated with phytosporin and sodium humate in June-July, but 4% of the plants were affected by this disease. The affected plants were removed from the test plot. During the research, the dates of plant development were noted (fig. 1)

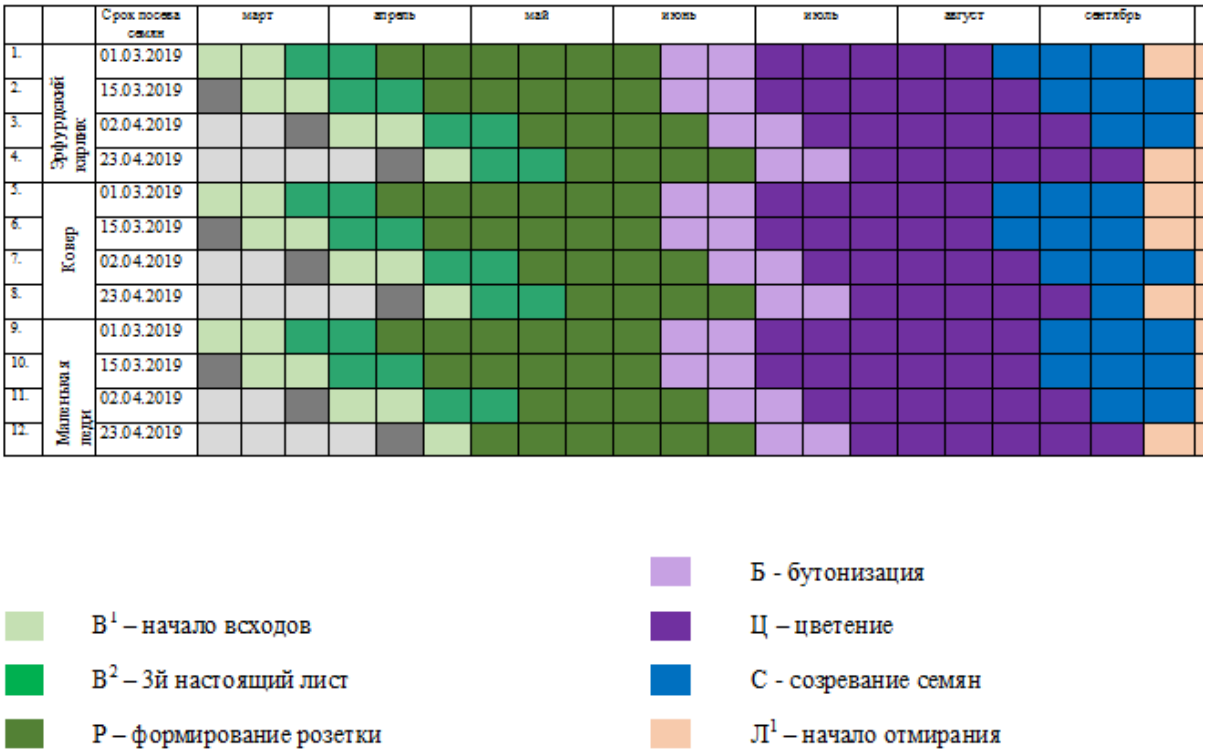

Figure 1 – Phenological spectrum of plant development

Seedlings appeared 4-5 days after sowing on all dates. The earliest and most friendly seedlings were of the Carpet cultivars. The beginning of flowering at sowing on March 1 and 15 was recorded in the Erfurd dwarf cultivar from June 28 to 30, with late sowing on April 2 and 23 from July 12 to 26. Carpet and Little Lady - with early March sowing of seeds, the beginning of flowering was celebrated from 1 to 4 July, with late sowing - from 13 to 30 July. The beginning of mass flowering was noted from the moment of blooming 50% of all flowers on a given plant or group of plants: Erfurt dwarf from July 22-23, Carpet - July 25-27, Little Lady - July 27-28, with early sowing of seeds. When sowing seeds from April 2, the mass flowering date was noted for the Erfurt dwarf on August 4, Carpet - August 7-8, Little Lady - August 15. With a sowing period of April 23 - August 24-25, August 27-28 and August 29-31, respectively, by cultivar. The end of flowering is considered the moment of the final loss of the inflorescence of its decorative quality (even if there are still some non-wilted flowers that no longer have a decorative effect). These dates fell for all varieties of early sowing in the second and third decades of August, for late sowing dates shifted by every 10 days. In the Erfurt dwarf and the Little Lady, the loss of decorativeness was noted at the sowing date of April 2, September 10-12, Carpet - August 26-30. With a late sowing date on April 23, Erfurt dwarf and Little Lady - September 18-21, Carpet - September 8-10.

Thus, in the agrometeorological conditions of 2019, the flowering time of plants was 51-62 days. Long flowering time for cultivars Erfurd dwarf and Little Lady - 60-62 days regardless of the time of sowing seeds, shorter flowering time for cultivar Carpet, it was 51-52 days.

The possibility of obtaining high-quality seed material of *Callistephus chinensis* (L.) directly depends on the place of cultivation, weather conditions, the level of agricultural technology and the characteristics of the selected varieties. It was revealed that under the conditions of the south of the Amur Oblast, with a plant nutrition area of 25 × 25 cm, the maximum maturation of seeds was shown by plants of the first and second sowing dates in all studied varieties (sowing 03.01.2019 and 03.15.2019). About 60-70% of seed ripening was noted in plants of the third sowing date on April 2, plants of the last sowing date on April 23 did not give ripe seeds.

The decorativeness of the plants was assessed. According to V. Kotov's classification, *Callistephus chinensis* (L.) plants, depending on the height of the bush, are divided into four groups: dwarf varieties should have a bush height of up to 20 cm, undersized - 21-30 cm, medium-sized - 31-60 cm, tall - 61- 80 cm, and giant ones - more than 80 cm. According to the characteristics of producers, all selected groups (varieties) belong to undersized (height from 21 to 30 cm). In conditions of high humidity in the rainy summer of 2019, the Erfurt dwarf variety reached a height of 50-55 cm, Carpet - 40-45 cm, Little Lady - 30-35 cm.Accordingly, they all showed themselves as medium-sized in the south of the Amur Oblast.

The shape of the bushes can be pyramidal, columnar, oval, wide strong and wide spreading. The Erfurt dwarf had a broad, robust bush shape; Carpet and Little Lady - a spreading fragile bush shape.

According to the flowering time, the varieties are divided into early (from early July to mid-September), medium (from late July to October), late (from mid-August to frost). According to the characteristics of the varieties declared by the producers, Carpet and Little Lady should begin to bloom in July and, accordingly, can manifest themselves as early or medium. The Erfurd dwarf variety is declared as very early - flowering should begin in June. In the course of the study, it was revealed that the Erfurt dwarf under local conditions showed early flowering times, but not very early ones. Carpet varieties correspond to the declared (early or medium) flowering periods. The Little Lady cultivars have a pronounced average flowering time.

The studied varieties belong to semi-double and double varieties. Erfurt dwarf - about 70% double and 30% semi-double inflorescences. Carpet - about 50% terry and the same number of semi-double inflorescences. Little lady - about 60% double and 40% semi-double inflorescences.

In the color of the inflorescences, the varieties range from white to dark red, and from white to dark purple. One of the varieties of the Carpet group (cultivar type) has the rarest yellow color found.

By the size of the inflorescence, plants are classified with small (up to 4 cm in diameter),

medium large (up to 6 cm in diameter), large (8-10 cm in diameter), giant (about 10 cm in diameter). The studied varieties had an average inflorescence size of 6 cm, respectively, they all belong to medium-large varieties.

According to the direction of use, there are varieties of shear, casing, pot and universal. Cutting varieties are distinguished by particularly spectacular large inflorescences on long and strong peduncles. Casing varieties, as a rule, have a compact habit, a large number of inflorescences, and bloom profusely and for a long time. The studied grades are casing grades.

To describe the studied plants, the classification of N.A. Petrenko, according to which plants are divided into three large classes. Classes are divided into types depending on the structure of the inflorescences, types into groups or varieties, differing not only in the structure of the inflorescences, but also in their shape, as well as in the habit of the bush. Varieties within a group (variety type) differ mainly in the color of the inflorescences.

The decorativeness of the studied plants was assessed during the period of mass flowering according to the most important decorative characteristics: the number of branches of the 1st and 2nd order, the length of the peduncle, the number of flowers on the peduncle, the size and shape of the inflorescence, the resistance of the inflorescences to unfavorable meteorological conditions, decorativeness in cut.

Each sign of decorativeness was assessed within a five-point scale. The result obtained is the arithmetic mean of the assigned points for each indicator and was the final assessment of the characteristic.

The most decorative variety was shown by the Erfurd dwarf variety, whose inflorescences had a rich red or dark pink color. Inflorescence baskets are mostly terry. Peduncles are straight, leafy, of sufficient length for cutting. Stable in all weather conditions. The cultivar showed the longest flowering period of 60-61 days.

The variety Carpet showed good resistance to diseases in conditions of high humidity, but the inflorescences were not resistant to such conditions, which manifested itself in the loss of their decorative effect. Also, a loss of decorativeness was noted in the inflorescences of the Yellow carpet variety under arid conditions at elevated temperatures and high insolation, which was manifested by fading and a strong loss of decorativeness at the end of mass flowering.

The Little Lady cultivar had an average decorative score, had the smallest number of flowers on the peduncle -1-2, the inflorescence was double and semi-double, moderately resistant to high temperatures and humid conditions.

Thus, the cultivars *Callistephus chinensis* (L.) were studied in the southern zone of the Amur Oblast. All studied cultivars have a sufficient flowering period, which is important for a short growing season in the south of the Amur Oblast. At an early date of sowing, full-fledged

seed material was obtained for seedlings. The most promising variety is the Erfurd dwarf variety, which showed the greatest resistance to agrometeorological conditions of the growing season and received the highest assessment for decorative features. This variety can be used to expand the range of annual flower crops when landscaping Oblast territories.

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