

FLORICULTURE

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**PERSPECTIVE ASSORTMENT OF CULTIVARS, SORTS AND CONCULTIVARS OF
ZINNIA L. GENUS GROWING IN THE PIEDMONT ZONE OF THE CRIMEA****Svetlana Igorevna Tukach**

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Introduction

Principal task of introduction research is to mark out the most valuable, qualified for commissioning, gradation and practice in landscape gardening, cultivars among species diversity of ornamental plants.

This process is based on rate of morphological and biological properties of floral plants, noted for the economical and commercial value. Particularly, plant morphological characteristics of definite cultivar provide its ornamental features. Biological properties determine weather-, diseases- and pests-resistance, while economic value is expressed in adapting of blossoming terms and seed maturation, keeping of ornamental properties and seed productivity.

Though first and foremost introduction process consists in plant assortment, capable to adapt to new culture conditions based on botanical and geographical analysis and discovery of lands – climatic analogues.

Zinnia L. genera of Asteraceae family is an annual herbaceous plant, originated from Caribbean region of Neotropical floral kingdom (Home – Mexico). Its areal occupies North, Central and South America [6]. Its natural habitat is stony canyon ledges, 1500 m above the sea level [4]. After introduction *Zinnia* was widespread on territories, situated close to natural habitat as a flower crop, noted for diversity of ornamental characteristics and economic-biological properties that permit to adapt to dry summer and high level of insolation.

Hydrothermal coefficient (HTC) by G.T. Selivanov [7], base for identification of compliance to growing area climate, makes it possible to discuss that climatic peculiarities of plant habitat with dry and hot summer as well as habitat with quite wet winter (HTC under 0,5) could be a precondition for *Zinnia* L. introduction prospects rate in new edapho-climatic conditions of Piedmont Crimea (HTC under 0,7).

Zinnia as an annual floral crop with high adaptive capacity to new climatic conditions with high level of ornamentality is possible to replenish assortment of permanent flowering plants used within open sunny lands where air and soil temperature reaches considerable points above zero [3].

Z.violacea Cav. and *Z.haageana* Regel are the most widespread cultivars. About thousand cultivars has been selected by present, they are united into garden groups according to inflorescence construction, semifloret form and plant height [8].

Nowadays *Zinnia* can be found in catalogues of many botanical gardens in CIS and all over the world in general [9,10]. Though making collection funds is only precondition of the next introduction stage – comprehensive study, comparative cultivar rate and selection of the best species for floricultural points.

In spite of wide species diversity of *Zinnia* L., rather limited assortment is used in landscaping of cities and private areas. Investigation of biological and morphological peculiarities of species and cultivars from *Zinnia* L. genus, growing within Piedmont Crimea is still urgent task.

Study objective is to develop perspective assortment of *Zinna* L. genus for green building in piedmont zone of the Crimea. The objective is possible to implement due to complex cultivar rate of ornamental and economic-biological characteristics.

Objects and methods of the research

Study objects were three cultivars, ten species and four concultivars from *Zinna* L. genus, which were picked out of collection in Steppe department of Nikita Botanical Gardens – National Scientific Centre (NBG-NSC) and All-Russian research Institute for selection and seed-growing of floral and vegetable crops in Moscow region, and introduced in piedmont zone of the Crimea. Study cases: *Zinnia peruviana* L., *Z. haageana* Regel. and *Z. violacea* Cav., and derived species *Z. violacea*: ‘Imperator’, ‘Mechta’, ‘Oreol’, ‘Solnechniye zaichiki’, ‘Golden Down’, ‘Lavandel’, ‘Orange King’, ‘Polar Bear’, ‘Purple Prince’, ‘Scarlet Flame’, and concultivars ‘Dahlia like mix’, ‘Liliput’, ‘Raduzhnaya mix’, ‘Chysanthemum like smes’.

Method of descriptive morphology, state strain test were applied in terms of the research [4]. Phenological observations were guided by methodic of floral crop rate by V.N. Bylov [1]. Ornamentality and economic-biological properties were assessed according to 100-points system, which was modified for work with representatives of *Zinnia* L. genus; this system consists of: plant habitus, a number of n-th order shoots, length of flower-bearing stem, inflorescence color, size and form of inflorescence, total amount of flowers and inflorescences, degree of inflorescence doubling, abundance of blooming, blooming period, seed productivity, disease- and pest-resistance (especially resistance to oidium).

Findings were statistically processed.

Results and discussion

For the first time on base of TNU Botanical garden under conditions of Piedmont Crimea collection fond of *Zinnia* L. genus was formed. Total compatibility rate of ornamental and economical- biological characteristics inherent for *Zinnia* L. genus, is a criterion for introduction of flowering ornamental crops in landscaping within Piedmont Crimea.

As a result of cultivar assessment according to complex of ornamental and economic-biological characteristics of *Zinnia* L., which included study of morphological features of inflorescences, plant habitus, blooming period, the most prospective specimens were marked out of collection fond; they composed assortment, which was tested and recommended for landscaping within Piedmont Crimea.

Promising assortment included three cultivars (*Z. violacea*, *Z. peruviana*, *Z. haageana*), four sorts (“Sonechniye Zaichiki”, “Polar Bear”, “Purple Prince”, Orange King”), three concultivars (*Zinnia* Dahlia Mix and *Zinnia* Chrysanthemum Mix, Lilliput Mix) of *Zinnia* L. and representatives of two garden groups – giant and dwarf zinnias. Garden group of giant zinnias is composed of specimens with dahlia inflorescences (“Orange King”, “Polar Bear”, “Prince Purple”, conculcivar *Zinnia* Dahlia mix) and *Zinnia* Chrysanthemum Mix (conculcivar *Zinnia* Chrysanthemum Mix), while garden group of dwarf zinnias is represented by pompon inflorescences (conculcivar Lilliput, cultivar “Solnechniye Zaichiki”).

Z. violacea cultivar and conculcivar description, that is assortment for landscaping within Piedmont Crimea is presented below.

Garden group – giant zinnias (*Z. elegans grandiflora robusta plenissima*)

Zinnia Dahlia Mix – 90 sm tall. Shooting system consists of central upright shoot 50 sm tall and laterals: 7 first-order shoots 45-50 sm long with 14 second-order shoots 30-35 sm

long which in turn form 10 third-order shoots 10-15 sm long. Central and first-order lateral shoots form 7 foliaceous pairs with opposite arrangement, while the following-order shoots form less number of them: second- order – 6, third-order – 5 pairs of leaf sheets. Central and lateral shoots end with dahlia inflorescences, their doubling degree varies from simple to densely doubling. Color range of semiflorets presents yellow, orange, crimson, red and vinous tints. Diameter and height of the central shoot inflorescence makes 8,8 sm and 4,7 sm, first-order – 7,9 sm and 4,0 sm, second-order – 7,2 sm and 3,7 sm, third-order – 6,7 sm and 3,5 sm respectively. Due to large morphometric parameters of inflorescences their number per plant doesn't make more than 10-12 units over entire blooming period. Each inflorescence of all cultivar plants are capable to set viable seeds, which get ripening until frost.

Blooming period of the conculvar under conditions of Piedmont Crimea makes 67 days in case of non-seedling cultivation and 61 days if seedling cultivation is used. **Zinnia Chrysanthemum Mix** – height of plant makes 70 sm. Central upright shoot is 40 sm high with laterals: 8 first-order shoots 20-25 sm with 10 second-order shoots on them 20 sm long, where in turn 6 third-order shoots 10-15 sm high occur. Shoots are foliate, leaves are smooth-edged, opposite. On the central shoot 7 pairs appear, on first-order shoot - 6, second-order - 5, third-order - 3 leaf plates develop. Semifloret forms uncommon chrysanthemum – shaped inflorescences with oblong and twisted petals a bit. Half-double, double and densely double inflorescences of lilac, pink, carmine and beige color are typical for this conculvar. Over vegetative period about 7-8 inflorescences occur on one plant. Diameter and height of central shoot inflorescence makes 10,5 sm and 4,0 sm, first-order – 8,5 sm and 3,6 sm, second-order – 6,2 sm and 2,7 sm, third-order – 3,5 sm and 2,3 sm respectively. Seeds and inflorescences of the third-order don't get ripening until frosts with Piedmont Crimea.

In case of seedling cultivation blooming period in Piedmont Crimea makes 41 days, and starts in the middle of July.

“Purple Prince” – 50 sm high. Shoot system is presented by central upright shoot 45 sm high and laterals: first-order – 10, second-order – 13, third-order – 6 shoots, 25 sm, 20 sm and 15 sm long respectively. The following order of shoots grows over the previous one, and as a result deflowered inflorescences are covered by leaf mass of the following shoots. On central and lateral shoots of the first-order 5-7 pairs develop, second-order – 5 pairs, third-order – 3 pairs of leaves with opposite leaf arrangement. Central shoot and laterals end with Dahlia – shaped inflorescences. Flowers on inflorescences can be classified into two types: semifloret (purple-crimson) and disk floret (yellow). In terms of one populations there is a point to talk about plants with simple and half-double inflorescences. Over the whole vegetative period 3-4 inflorescences on average develop on one plant. Diameter and height of the central inflorescence makes 7,0 sm and 4,2 sm, first-order inflorescences – 5,8 sm and 2,8 sm, second-order – 5,4 sm and 2,6 sm respectively. The third-order inflorescences don't develop or blossom out, as they are subjected to frost damages on the stage of colored buds. Under conditions of Piedmont Crimea seeds collected from flowered inflorescences are capable to get ripening until the first air frosts in the middle of October – beginning of November.

Blooming period in the middle of May under conditions of Piedmont Crimea makes 71 days in case of sowing in open ground, but if seedling cultivation – 60 days.

“Polar Bear” – plants reaches 70 sm high. Shoot system is presented by central upright shoot 45 sm high and laterals: 6-7 first-order shoots 40-45 sm long, 11 second-order shoots on them 25-30 sm long where in turn 7 third-order shoots start developing, which don't reach full length until first frosts and keep the stage of 2-4 leaf pairs. Leaf arrangement is opposite. On the central shoot 7 pairs of leaves develop, on the first-order shoots – 6 pairs, on the second-order shoots – 5 pairs, on the third-order - 3 pairs. Central shoots and laterals

end with Dahlia like mainly simple inflorescences, though population includes double and densely double as well. Inflorescence flowers are classified into two types: semifloret (white) and disk floret (yellow). At the same time there are plants with simple and half-double inflorescences in population. Over the whole vegetative period 3-4 inflorescences develop on one plant. Diameter and height of inflorescences on the central shoot and laterals is various. In this way than younger laterals than smaller morphometric parameters of inflorescences. Therefore diameter and height of the central inflorescence makes 6,8 sm and 3,4 sm, first-order inflorescence – 6,3 sm and 3,2 sm, second-order – 5,4 sm and 2,7 sm. Viable seeds develop on them under conditions of Piedmont Crimea in the end of September – beginning of October until the first frosts.

In the middle of May blooming period in Piedmont Crimea in case of sowing in the open ground makes 65 days, what is 9 days longer than using seedling cultivation.

“Orange King” – plant height gets 60 sm. Shooting system is a central shoot 30 sm high and laterals: first-order – 4, second-order 5 shoots, 30 sm and 20 sm long respectively. Laterals of the third and further orders don't form. 7 pairs of leaves with opposite arrangement develop on the central shoot, on the first-order shoot – 6 pairs, second-order – 5 pairs. Central shoots and laterals end with Dahlia-shaped inflorescences which have flowers of two types: semifloret (bright-orange) and disk floret (yellow). They develop half-double and double inflorescences. In total 3-4 inflorescences per one plant develop during vegetative period. Diameter and height of the central inflorescence make 7,0 sm and 4,2 sm, first-order – 7,4 sm and 2,5 sm, second-order – 8,1 and 3,0 sm respectively. Seeds are capable to get ripening until frosts.

Blooming period makes 68 days allowing for conditions of Piedmont Crimea and sowing in the open ground in the middle of May, while in case of seedling cultivation it is 55 days.

Garden group – dwarf zinnias (*Z. elegans flore pleno pumila*).

“Lilliput” – height of the compact and dense plant makes 35 sm. On the central shoot, there are 25-30 sm high, 7 first-order 30-35 sm long, 17 second-order shoots 25-30 sm and 19 third-order shoots 20-25 sm. Shoots are foliaceous with opposite leaf arrangement. 6 pairs of leaves develop on the central shoot, on first and second-order – 5 pairs, third – 4 pairs. Developed pompon inflorescences on plants are composed of closely adjoining growing in a tile way along the full length semiflorets. They are lilac, carmine, white and pink – shadowed. In this way disk flowers keeps yellow color constantly. Within this sort, as an exclusion, there are plants with simple and double inflorescences. In total over the vegetative period on average 16-17 inflorescences develop per one plant, 4,8 sm across diameter and 2,8 sm high. Depending upon lateral order diameter and height of inflorescences ranges as follows: first-order – 4,5 sm and 2,3 sm, second-order – 3,3 sm and 1,7 sm. The third-order inflorescences aren't capable to develop until frosts and stay on the stage of colored buds. The rest inflorescences form viable seeds under conditions of Piedmont Crimea.

Blooming period that starts under conditions of Piedmont Crimea applying non-seedling cultivation makes 55 days.

“Solnechniye zaichiki” – height of the compact plant makes 40 sm. Central shoot is upright and reaches 25 sm high. On average 38 laterals develop on the plant, 6 of them are first-order 30-35 sm long, 15 second-order shoots 20-25 sm long, 17 third-order shoots 15-20 sm long. Leaves with opposite arrangement develop on the central shoot – 5 pairs, first order – 6 pairs, second-order – 5 pairs and third-order shoots – 4 pairs. Bright yellow semifloret and disk flowers form inflorescences of several types: simple, half-double, double and pompon. On average 12-13 pompon inflorescences develop on the same plant. Diameter and height of the central inflorescence makes 3,7 sm and 2,65 sm, first-order inflorescences – 3,2

sm and 2,9 sm, second-order – 3,2 sm and 2,3 sm, third-order – 2,6 sm and 1,3 sm respectively.

Blooming period that starts in the end of July under conditions of Piedmont Crimea if open ground makes 78 days, while in case of seedling cultivation it starts in the middle of June and makes 58 days.

As a study assortment was divided into garden groups, cultivar rating covers general ornamental effect of this cultivar groups as well.

Comparative cultivar rating of two garden groups of giant and dwarf zinnias revealed that giant zinnias have more oblong, spready habitus form, which form 25-30 laterals, while dwarf compact zinnias have 38-43 laterals. Dwarf zinnias have more inflorescences (from 13-17) in comparison with giant zinnias (4-8) what increases their ornamental value [7].

In course of the research considerable powdery mildew susceptibility of zinnia plants was fixed, what decreases general ornamental effect of cultivars to a large degree. Thereby presowing treatment with complex fungicides and further spraying works is recommended during the rainy period. To prevent zinnias from fungal diseases they are cultivated on warm and open areas with well permeable soil and root irrigation in especially dense plantings of flower gardens.

As a result of blooming period assessment and blooming terms rate the following cultivars were marked out: early-, medium- and late-blooming cultivars. In this way for convenience *Zinnia* L. assortment could be classified into cultivars recommended for flower gardens with constant and variable blooming process. Cultivars recommended for constant blooming flower gardens, that is early-blooming ones, get inflorescence opening in the second decade of June, but blooming period lasts till the end of October - beginning of November depending upon first air frosts according to research years. Cultivars, recommended for flower gardens with variable blooming, that is medium- and late-blooming plants, demonstrate inflorescence opening since the third decade of June till the second decade of July, but blooming period lasts up to first frosts. Allowing for sequence of blooming cultivars and sorts of *Zinnia* L. could be recommended for composition flower gardens in combination with other annual plants that start up blooming earlier, but require the same irrigation and insolation regime as zinnias do. At the same time *Zinnia* L. cultivars and species could be combined with sorts of the same cultivar or other annual plants to gain round-year blooming. In such flower gardens zinnias are possible to accompany with summer-blooming *Tagetes patula* L., *Verbena officinalis* L., *Calendula officinalis* L. and autumn-blooming sorts of asters and chrysanthemums.

Zinnia L. cultivars and sorts that demonstrate permanent blooming can be recommended for homogeneous groups and lands. There are cultivars and sorts that start up blooming in the first decade of July: cultivar *Z. peruviana*, *Z. haageana* (04.07), sort “Oryol” (01.07), sort “Golden Down”, “Lavandel”, “Polar Bear” (04.07), concultivars Dahlia- and Chrysanthemum-like mixes (10.07).

Zinnia L. assortment recommended for Piedmont Crimea includes cultivars, sorts and concultivars, that present plants of different height, what extends use range of this flower crops in various flower gardens.

The most advantageous planting place for zinnias is one-sided or two-sided bed-borders. One-sided bed border is usually planned along building, edges and fences walls and along the perimeter of areas, that is why *Zinnia peruviana* L., *Z. violacea* and giant multicolored concultivars of Dahlia and Chrysanthemum Mixes could successfully form their base. Two-sided bed border located in the centre of an alley or a garden path, lawn, otherwise where it is well within view, could be supplemented by one-color cultivar *Z. Peruviana* sorts of *Z. violacea* “Golden Down”, “Lavandel”, “Orange King”, “Purple Prince”, “Scarlet Flame”. In this way external edges of two- and one-sided bed borders are possible to

emphasize with dwarf cultivar *Z. Haageana*, sorts of *Z. Violacea* “Solnechniye zaichiki” and “Lilliput” or various chipping gravel and pebble or crushed stone. So-called carpet annual flower beds or borders made of dwarf zinnias of these cultivars have spectacular view as well.

Cultivars and sorts differ not only by height, but peculiarities of the main ornamental characteristic – inflorescence. According to inflorescence structure, color and size diversity of sorts and concultivars are possible to combine for floristic compositions in urban landscaping and private territories, allowing for morphologic parameters of generative sphere and plant height under conditions of Piedmont Crimea.

One-colored zinnias with bright-colored inflorescences (“Oreol”, “Solnechniye Zaichiki”, “Orange King”, “Purple Prince”, “Lavandel”) do for not very high one-crop flower gardens, while sort mixes (dahlia, chrysanthemum, raduzhnaya) and conculcivar “Lilliput” goes well in tiered flower gardens.

In this way representatives of two garden groups of *Zinnia* L. genus make different ornamental effect. Garden group of dwarf zinnias characterized by compact habitus with numerous laterals and impudent blooming could be recommended for floristic design of bed borders and parterre flower gardens. Garden group of giant zinnias with branchy shape of bush, not so many laterals and a few of large inflorescences could fit for multitiered flower gardens.

Conclusions

To extend assortment of drought-resistant annual flower crops in Piedmont Crimea the following was recommended: three cultivars of *Zinnia* L. genus (*Z. violacea*, *Z. peruviana*, *Z. haageana*), four sorts and three concultivars of *Z. violacea* “Solnechniye Zaichiki”, “Polar Bear”, “Prince Purple”, “Orang King”, “Lilliput”, Dahlia and Chrysanthemum Mixes with a high degree of ornamental properties and prolonged and impudent blooming period.

Blooming period in case of non-seedling cultivation is 10 days longer on average, than if seedling method is used. That’s why seed sowing into open ground is more reasonable in the second decade of May under conditions of Piedmont Crimea.

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Collection stock of *Zinnia L.* genus growing in Piedmont zone of the Crimea was brought together for the first time. Assortment that includes three cultivars of *Zinnia L.*, three cultivars and three concultivars of *Zinnia violacea Cav.* were tested and recommended for green building in the given region. According to results of introduction study and complex cultivar rating there is a description of biomorphologic, phenologic, ornamental peculiarities of cultivars and sorts belonging to *Zinnia L.* genus, which composed a new assortment for Piedmont Crimea conditions.

Key words: *Zinnia violacea Cav.*, *Z. peruviana L.*, *Zinnia L.* genus, landscape gardening, perspective assortment, Piedmont zone of the Crimea.