IMPROVEMENT OF *DAYLILIES* (*HEMEROCALLIS* L.) IN THE REPUBLIC OF MOLDOVA

AMELIORAREA CRINULUI GALBEN (*HEMEROCALLIS* L.) ÎN REPUBLICA MOLDOVA

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Abstract. *The genus Hemerocallis L. has long been attributed to the Liliaceae family, then to the Hemerocallidaceae family. Since 2009, on the basis of phylogenetic analyzes, it has beenattributed to the Xantorriaceae family.The species of Hemerocallis are spread in the temperate zones of Oriental Asia, especially in China, in the peninsula of Korea, Japan, Siberia. The most northern species can be considered Hemerocallis lilioasphodelus or H. flava, which is found in the Obi river basin and in Western Siberia. The genus Hemerocallis, the species H. flava, H. fulva are characteristicfor the flora of Europe. Many species of this family are grown as ornamental ones. The paper presents the results of the improvement of the species and varieties of the genus Hemerocallis L., the methods and stages of obtaining some forms and varieties of Hemerocallis hybrida Hort, the forms of Hemerocallis hybrida Hort., with decorative qualities superior to the parent plants.*
Key words: *Hemerocallis*, species, varieties, improvement, methods of improvement, new forms, morphology, phenology

Rezumat. *Genul Hemerocallis L. a fost mai mult timp atribuit familiei Liliaceae, apoi familiei Hemerocallidaceae. Din 2009 a fost acceptat, pe baza unor analize filogenetice, la familia Xantorriaceae. Speciile genului Hemerocallis sunt răspândite în zonele temperate a Asiei orientale. În special în China, peninsula Coreea, Japonia, Siberia. Cea mai nordică specie poate fi considerată Hemerocallis lilioasphodelus sau H. flava ce se întâlneşte în bazinul râului Obi şi Siberia occidentală. Pentru flora Europei din genul Hemerocallis sunt caracteristice speciile H. flava, H. fulva. Multe specii ale acestei familii sunt cultivate ca ornamentale. În lucrare sunt prezentate rezultatele ameliorării speciilor şi soiurilor din genul Hemerocallis L., metodele şi etapele căpătării unor forme şi soiuri de Hemerocallis hybrida Hort., formele de Hemerocallis hybrida Hort. cu calităţi decorative superioare formelor parentale.*
Cuvinte cheie: *Hemerocallis*, specii, soiuri, ameliorare, metode de ameliorare, forme noi, morfologie, fenologie

INTRODUCTION

The name of the *Hemerocallis* genus was given in 1753 by Swedish botanist Carl Lineus in his first publication "Species plantarum".

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The genus *Hemerocallis* L. has long been attributed to the family Liliaceae, then to the Hemerocallidaceae family, this fact is stated in the literature. Since 2009, on the basis of phylogenetic analyzes, ithas been attributed to the Xantorriaceae family which is divided into 3 subfamilies of Hemerocallidoidae, Asphodeloideae and Xanthorrhoeoideae. Family representatives have a wide geographical distribution, although they are predominantly found in tropical and temperate regions of the globe. Many species of this family are grown as ornamental ones.

The species of *Hemerocallis* are spread in the temperate zones of Oriental Asia, especially in China, in the peninsula of Korea, Japan, Siberia. The most northern species can be considered. *Hemerocallis lilioasphodelus* or *H. flava,* which is found in the Obi river basin and in Western Siberia. The genus *Hemerocallis*, the species *H. flava, H. fulva* are characteristic for the flora of Europe (Седельникова, Челтыгмашева, 2017).

At present, 19 species of the genus *Hemerocallis* are described by various authors: *Hemerocallis auranțica* Baker*; H. fulva* L*; H. disticha* Donn.*; H. longituba* Miq*; H. Dumortieri* Morr.*; H. Middendorfii* Trautv. et. Miq.*;H. esculenta* Koidz.*; H. pedicellata* Nakai.*; H. flava* L.*; H. minor* Mill.*; H. sulphurea* Nakai.*; H. Thunbergii* Baker.*; H. citrina* Baroni.*; H. coreana* Nakai.*; H. Forrestii* Diels.*; H. nana* Forreest. et Smith.*; H. plicata* Stapt.*; H. multiflora* Stoun.*; H. exeltata* Stout. (Stout, 1930; Turcinscaia, 1973).

Hemerocallis or Daylily is represented in the contemporary ornamental horticulture by older varieties from the 40s-50s. There are fewer varieties of the 70's of the 20th century. The most contemporary varieties are the tetraploid, of American selection. In Europe, the most common varieties of *Hemerocallis* are the hybrid forms - very precious in ornamental terms.

Its foliage determines the overall appearance of the plant.

The plants getthe most spectacular aspect during flowering. Most varieties bloom between 30-45 days, some varieties up to 60 days.

The right choice of varieties in green spaces can ensure their decorative aspect up to 60-75 days. Flowers have a special role in ensuring the decorative aspect to the space because they contain a wide range of different shades of yellow, orange, red, pink, purple.

Some species or *Hemerocallis* varieties, especially those with yellow flowers, have a fine flavor. The Daylily can be successfully used in interior design. The character of its growth and development, in this context, determines the types of propagation to the Daylily the biological properties are important.

In the collection of ornamental plants of the National Botanical Garden (Institute) "Alexandru Cibotaru", 5 species, 17 international selection varieties and 9 national selection varieties are currently registered. The research on their biological peculiarities has taken place over longer periods of time. The study focused on bio-morphological features, ornamental qualities, and vegetative productivity.

The research activity has been going on for many years in the direction of enriching the *Hemerocallis* collection in both species and varieties. Based on the existing collection, works have been carried out to improve, to obtain new forms.In

the result of crossbreeding, more ornamental forms were obtained, 9 of which were certified as ornamental plant species.

MATERIAL AND METHOD

Under the conditions of the Republic of Moldova, Daylily does not form seeds without artificial pollination. The generation obtained from seeds is not uniform, so generative multiplication can be used for the amelioration and acquisition of new forms and varieties.

In order to obtain new forms, hybrids and varieties of *Hemerocallis*, we used the cross-pollination method for obtaining the first generation hybrids by their subsequent vegetative propagation. Selection methods have been adapted to local conditions as found in the specialty literature (Turcinscaia, 1973, Улановская, 2015).

The selection works were carried out by us in the direction of acquiring the varieties with diverse flowering terms from the early to the late ones and with the reboundeffect while flowering. An important point is to receive the forms with a larger number of flowers in inflorescence, and tend to keep a single flower several days in bloom.

When choosing pairs forthe crossbreeding, we have been guidedby the ornamental qualities of these varieties: the term and duration of flowering; flower ornamental properties; the dimensions, color and silhouette of the petals; resistance to diseases and pests.

The duration of the observations allowed appreciating the quality of the obtained forms according to the following criteria: the color of the perianth, the dimensions and shape of the inflorescence axis, the resistance, the shape of the inflorescence, the abundance of flowering, the decorative nature of the leaves, the shape of the bushes, the originality of the new form.

The main criterion for decorative appreciation is the color of petals. Valorous are considered flowers with vivid colors and original shapes, miniature or gigantic flowers.The traits that determine this decorative aspect are:the height of the inflorescence axis; petals: narrow, wide, wide apart between them, semi-distant, adjoining, crooked (up, down), the color of the petals (uni-, bi-color), spot (eye) at the base, or in the tip of the petal, embossed; the duration of flowering within an inflorescence and a plant; flowers with aroma and without; the flowering during the day or at night.

Appreciating the decorative nature of the bush,it is preferable for the foliage to be at a lower level than the inflorescence axes, forming a compact rosette.

Since there are no exact data on the provenance of the contemporary *Hemerocallis* varieties when choosing the paternal pairs forthe crossbreeding, we have been guidedby the ornamental qualities of these varieties, the main qualities being:

1. The term and duration of flowering;
2. Flower ornamental properties: size, color and silhouette of the petals;
3. Resistance to diseases and pests;
4. Having information about paternal forms.

The works are accomplished in several stages:

a) choosing parental forms according to the convenient criteria for the final ones drawn by us;

b) collection of pollen in test tubes with their respective marking;

c) removing stamens from maternal forms and pollen deposition on the stigma of these flowers with the help of the brush;

d) Labeling of pollinated flowers with date of pollination and paternal forms.

The degree of maturation of the pollen and stigma is determined visually. Pollination is more effective when it is done at the beginning of the day, in the morning between 7.00-10.00 a.m. Later on sunny space the success of pollination is lower or fertilization does not take place at all. For the daylily it is characteristic that even after the petals have closed the stigma of the pistil remains fit for fertilization at least 24 hours.

The maturing of seeds takes place within 40-50 days after the pollination. The success of pollination can be checked after 4-5 days. If the fertilization did not take place, the ginkgo (gineceul) falls down with the flower bloom, in the positive case the ovary grows significantly in size, forming the fruit - capsule, in which the seeds gradually mature. Once the seeds mature, the capsule changes color from green to light brown. The right time for seed collection is when the color of the capsule turns light - brown and the valves start to open.

The seed capsules were collected until the seeds were completely matured (beginning of bleaching), and we fully cut the inflorescence. It was stored in canvas bags, hung on supports (suspended) in a dry and well-ventilated room.

The seeds are black with brown or blue shades, they quickly lose their ability to germinate, and that's why we've sownthem the same autumn or the following spring.

Seeds in soil germinate rapidly. They were sown directly in the ornamental sector on separate plots. The depth of soil incorporation was 1.5-2 cm. The young plants were transplanted at a distance of 30-40 cm in rows with a distance of 40 cm between them at the end of the first growing season. At the first flowering the most decorative forms were described and chosen.

During the observation periodthe plants that were weak or injured by diseases or pests were eliminated.

The final appreciation of all the components of the decorative aspect of the obtained forms was made in the 5th and the 6th year.

The duration of the observations allowed to appreciate the quality of the obtainedshapes by the following features: the color of the perianth, the dimensions and shape of the inflorescence axis, the resistance, the shape of the inflorescence, the abundance of flowering, the decorative nature of the leaves, the shape of the bushes, the originality of the new form.

The main criterion for decorative appreciation is the color of petals. Valuable are considered the flowers with vivid colors and original forms.

The traits that determine this decorative aspect are:

1. The height of the inflorescence axis;

2. Petals: narrow, wide, wide apart between them, semi-distant, adjoining, crooked (up, down), the color of the petals (uni-, bi-color), spot (eye) at the base, or in the tip of the petal, embossed;

3. The duration of flowering within an inflorescence and a plant;

4. Flowers with or without flavor;

5. Flowering during the day or at night.

Appreciating the decorative nature of the bush, it is preferable for the foliage to be at a lower level as the inflorescence axes forming a compact rosette.

RESULTS AND DISCUSSIONS

In the process of varieties improvement, several variants of crossbreeding were made, obtaining saplings, which were selected and repaired. The most successful variants were planted in the homologation sector. Currently, the forms that have the

highest degree of appreciation have been obtained from multiple crossbreeding of the following varieties:

Pink Lightning –the color of the yellow pink petals, at the base with a yellow-golden spot. The broad petals, heavily embossed, at the outer peaks are bent inside.Light green, semi-curved rosette leaves. The inflorescences are higher than the leaf rosette.

Chipper Cherry –dark red petals, with a small yellow spot at the base. The petals are wide open with a slightly curled edge. The leaves are green-dark, 2.5-3 cm wide, at the same level with the flowers.

Angel Mine –dark pink petals, with a more intense colored greenis spot at the base. The edge of the petalsis slightly wavy. The leaves are dark-green, about 4 cm wide, at the same level with the flowers.

Iveria –orange yellow petals, anthers of the same color as petals, semi-closed corolla. Light green, semi-curved green rosette leaves. The inflorescences are higher than the leaf rosette.

Missouri Beauty –yellowish-green flower. Petals semi closed, the inner ones wide with the rim heavily embossed up to half of the petal.The leaves in the rosette are narrow, light green, semi-curved.The inflorescences are higher than the leaf rosette.

Hercules

Iveria

Chiper Cherry

Fig. 1 Varieties initiated in improvement (author's photo)

Ciombe-variety with claret – dark flowers, narrow petals, rolled, and golden – yellowspot. Diameter 16 cm. Average flowering.

After the improvement works carried out during the years (1989-2016), several hybrids of daylily have been chosen, which were planted in the approved sector of the National Botanical Garden "Alexandru Cibotaru". The initial forms were cultivated in this sector and as a result of the approval the following forms were chosen which received their own names:

1. ♀ Iveria X♂ Missouri Beauty = Lămâița
2. ♀ Chipper Cherry X♂ Angel Mine = Columna
3. ♀ Hercules X♂ Pink Lightning = Coral
4. ♀ Chipper Cherry X ♂ Pink Lightning = Avântul
5. ♀ Chipper Cherry X♂ Pink Lightning = Farmec
6. ♀ *Angel Mine X ♂ ChiperCherry* =Melancolie
7. ♀*Chiper CherryX ♂ Ciombe*=Zamfira

Variety- **Lămâiță**. (plant variety patent No.356.1, 2005)

Parietal forms– ♀ Chipper Cherry x ♂ Angel Mine.

Compact bush with a medium degree of leaves growing. Linear-narrow leaves with arched, light-colored tops. The floral shaft reaches a height of 70-90cm, smooth, dark green. Flowers have the shape of a beige-colored somber funnel, the center is light-orange and 15-16cm in diameter. The inner and outer petals are nerve-free,the inner petals are wide and embossed, the outer narrow slightly corrugated and curved. The stamens are yellow. Flowers have very fine flavor. It blooms from the second decade of June until the end of July. It is resistant to diseases and pests. Recommended for green spaces and as flowersto be cut.

Variety – **Columna** (plant variety patent No.376.1, 2006)

Parietal forms - ♀ Chipper Cherry x ♂ Angel Mine.

Compact, uniform breeches with an average degree of leaves growing. Linear-narrow leaves with arched, light-colored tops. The floral shaft reaches a height of 70-90cm, smooth, dark green. Flowers in the shape of a beige-colored somber funnel, the center is light-orange and 15-16cm in diameter. The petals have pale tan nobs. The inner petals are wide and embossed, the outer ones are narrow, slightly embossed and curved. The stamens are yellow. The flowers have very fine flavor. It blooms from the second decade of June until the end of July. It is resistant to diseases and pests. Recommended for green spaces and as flowers to be cut.

Variety—**Coral** (plant variety patentNr.357.1, 2005)

Parietal forms–♀ Hercules x ♂ Pink Lightning.

Compact, well-rounded bush. Linear-intermediate leaves with light green arched tops. The floral shaft reaches the height of 40-60cm, smooth, dark green. Very decorative flowers in the shape of a red-lighted funnel with an orange-light center and 13-14cm in diameter. Flowers have orange-dark nobs. The inner petals of the flower have average dimensions with slightly curved edges curved downwards. The outer petals have slightly curved edges with protruding nibs. The stamens are red-orange. Flowers have a fine flavor. It blooms from the third decade of June until the end of July. It is resistant to diseases and pests. Recommended for green spaces.

Variety– **Avântul** (plant variety patent, 2006)

Parietal forms–♀ Chipper Cherry x ♂ Pink Lightning.

Compact, uniform, medium-sized bush. The linear-narrow leaves, with light green arched tops. The floral shaft reaches the height of 40-60cm, smooth, dark green. Flowers in the shape of a somber color funnel with yellow-gold center, diameter 14-15cm. Flowers have dark-colored nobs. The inner petals are wide, embossed and slightly curved. The outer petals are yellow. Flowers have a fine flavor. It blooms in the third decade of June until the end of July. It is resistant to diseases and pests. Recommended for green spaces and as flowers to be cut.

Variety – **Farmec**(plant variety patent Nr.375.1, 2006)

Parietal forms–♀ Chipper Cherry x ♂ Pink Lightning

Compact, uniform, medium-sized bush. Leaves are light green, linear-narrow, with arched peaks. Flower shaft 30-60cm high, dark green. The yellow-brick colored flowers are open in the shape of a funnel with a diameter of 14cm. The inner petals are beaded, corrugated and cherry-colored. The outer petals are straight, slightly

arched. Stamens are yellow. It blooms from the third decade of June until the first decade of August. Recommended for green spaces.

Variety-**Melancolie (** plant variety patent No.201, 2016)

Parietal forms–♀ *Angel Mine X* ♂ *Chiper Cherry*

Larger leaves, below the inflorescences. The height at flowering 80 cm, the leaves 50 cm. Flower in the form of a large open funnel. The color of the apricot. Diameter 17 cm. The inner petals are wavy, the outer ones are sharper. At base, yellowish golden spot.Lightly fragrant flowers. Inflorescence of 5 to 7 branches, each branch has 5 flowers. Plants aged 5-6 years form from 9 to 19 inflorescences.

Fig. 2 Varieties in the sector of improvement (author's photo)

Variety- **Zamfira (**Patent for plant variety Nr.200, 2016)

Parietal forms–♀*Chiper Cherry**X*** ♂ *Ciombe*

Leaves more narrow. Located almost at the same height with inflorescences at flowering. The height at flowering 80 cm. Flower-shaped funnel wide open lobes of sharp petals. Diameter 12 cm. Internal clamshell petals with a golden stripe in the middle. External yellow petals with claret. At the base of intense cherry contour. Inflorescence with 7 to 9 branches, each with 5 flowers. Plants of 7 to 9 years form from 20 to 35 inflorescences.

Melancolie *Lămâiță* *Zamfira*

Fig. 3 Varieties obtained by amelioration (improvement) (author'sphoto)

CONCLUSIONS

1. The analysis of phenorythm of species and varieties of the genus *Hemerocallis* L. indicates that the pace of their development is fully compatible with the climatic conditions of the Republic of Moldova. The growing season for most species and varieties is from 200 to 266 days. The blossoming of the most early species and varieties can be found in the conditions of reaching the current temperature of 220-290°C, in the morning - 970-1200°C and medium - 1700-2500°C. The flowering time and sequence depend on biological characteristics of species and varieties, lasting (20-60 days) - weather conditions.

2. We have found that the species of the genus *Hemerocallis* L. cultivated in Moldova form fruit with viable seeds, which indicates a sufficient degree of adaptation to the natural and climatic conditions of the introduction zone. It has been established that the greatest number of seeds can be obtained by artificial pollination.

3. It was noted the different capacity degree of species and varieties by vegetative propagation.

4. Pollen studies have allowed us to establish that pollen grains of all species and varieties studied in the genus *Hemerocallis* L. are elongated in the form of a pole and equator, elliptic, heteropolare, with a single distinct furrow, characterized by different morphometric characteristics. The varieties with a high content of viable pollen are distinguished, which characterizes them as resistant to the conditions in the region and which can be recommended as pollen donors to be used in breeding works.

5. The system of evaluation of *Hemerocallis hybrida* Hort varieties has been developed according to morpho-biological, decorative, propagation features.

6. Forms and varieties of *Hemerocallis* obtained under the conditions of the Republic of Moldova are resistant to diseases and pests. They have shown a high yield of propagation over the years. The period of vegetation is optimal and the plants with their foliage and flowers ensure a high decorative effect of the occupied spaces.

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