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COLLECTION FUND OF SPECIES AND CULTIVARS OF PLANTS *NIGELLA* L. GENUS IN M.M. GRYSHKO NATIONAL BOTANICAL GARDEN OF NAS OF UKRAINE

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Summary. A review of domestic and foreign literature, electronic resources on the origin, distribution and directions of use of plants of the *Nigella* genus was carried out. The results of the long-term introduction and selection work carried out in the of cultural flora department of the M.M. Gryshko National Botanical Garden in the context of the creation of a collection fund of species and cultivars of plants of the *Nigella* genus from different centers of origin and as a result of its own selection work are highlighted. The distribution of plant samples by morphogroups was carried out based on the assessment of their biometric parameters and morphological features, which in the future makes it possible to determine genotypes promising for breeding research.

Keywords: *Nigella* L., species and cultivars, morphological features.

Introduction

According to The World Flora (2021), more than 90 *Nigella* taxa reported, but only 23 from them are accepted, the rest are synonyms [1]. All these species are distributed in Southern and South-Eastern Europe, the Mediterranean, the Caucasus, Asia Minor and Central Asia, only 3 species – in Ukraine.

Since 1959, the chemical composition and medicinal properties of *Nigella sativa* L. (black cumin) have been actively studied [2-6]. The effectiveness of using *N. sativa* seed meal as a feed additive in poultry farming has been successfully tested [7-10]. The chemical composition of the seeds of *Nigella damascena* L., and *Nigella arvensis* L. is quite similar, so research on the medicinal properties of these species is promising [11-12]. It is very important to establish the characteristic taxonomic features of species [13-16]. Currently, *N. damascena* is mainly known as an ornamental plant. Considering the valuable medicinal and decorative properties, genotypic diversity, resistance to biotic and abiotic environmental factors, there is a great need to mobilize representatives of the genus *Nigella* in Ukraine. This will make it possible to have a rich genotypic base for the creation of high-yielding varieties to meet the needs of medicine, food industry and landscape construction.

The purpose of the work was to evaluate the collected over a long-term period in the department of cultural flora M.M. Gryshko National Botanical Garden (NBG) of the gene pool of plants of the genus *Nigella*, to demonstrate the difference in morphological features depending on species, shape and varietal characteristics.

Materials and methods

Objects of studies were: the collection fund plants of the *Nigella* L. genus at the National Botanical Garden of NAS of Ukraine includes 12 taxa: *N. arvensis* L., *N. ciliaris* DC., *N. damascena* L., *N. damascena* L. 'Risdviana zirochka', *N. damascena* L. f. duplex, *N. nigellastrum* L., *N. hispanica* L., *N. integrifolia* Regel, *N. orientalis* L., *N. sativa* L., *N. sativa* L. 'Diana', *N. sativa* L. 'Faraon' [17].

Methods of studies. Extensive field surveys and population investigations of taxa *Nigella* in NBG were carried out during the years of 2018–2023. The general appearance, structure and color of leaves, flowers, seeds and capsules of plants of the *Nigella* genus were studied during the growing season and compared with botanical descriptions in the scientific literature [18-19]. We mainly used POWO for identification of taxa *Nigella* [20-21].

Results and discussions

During the long-term introduction and selection work, the cultural flora department collected a valuable gene pool of useful plants (about 2,000 taxa), part of which, namely the "Collection Fund of Energy and Aromatic Plants of the M.M. Gryshko National Botanical Garden of National Academy of the Sciences of Ukraine" (more than 1,600 samples) is included in the List of scientific objects that constitute the National Heritage 28.01.2015 [22].

Among taxa of *Nigella* genus at NBG have been selected perspective forms, 3 cultivars of plants Nigella genus have been created by breeding. Cultivars have been recommended for cultivation in all agro-climatic zones of Ukraine and entered into the State Register of Plant Varieties of Ukraine [23] – *N. sativa* 'Diana', *N. sativa* 'Faraon' and *N. damascena* 'Risdviana zirochka'. Plants of the Nigella genus are distinguished by their morphological parameters depending on species, form and varietal characteristics. Such differences are especially pronounced in the morphology of plant flowers (Fig. 1). In this regard, the studied representatives were divided into the following groups: blue-flowered – *N. damascena, N. nigellastrum*; purple-flowered – *N. damascena* 'Risdviana zirochka', *N. hispanica*; yellow-flowered – *N. ciliaris, N. orientalis*; pale-blue flowered – *N. arvensis*; milk-white flowered – *N. sativa* 'Faraon'.

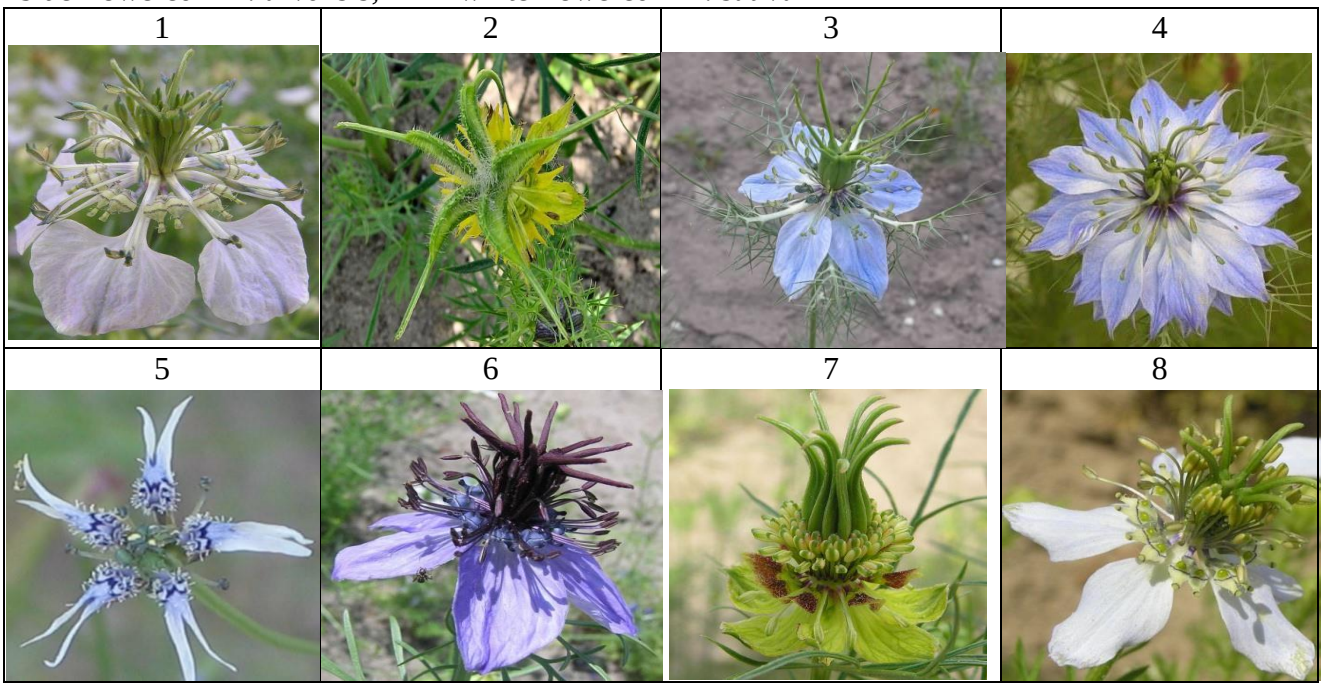


Figure 1. Flowers plants of species and cultivars of the *Nigella* genus: 1 – *N. arvensis*, 2 – *N. ciliaris*, 3 – *N. damascena*, 4 – *N. damascena* 'Risdviana zirochka', 5 – *N. nigellastrum*, 6 – *N. hispanica*, 7 – *N. orientalis*, 8 – *N. sativa* 'Faraon'

Seeds of representatives of the *Nigella* genus are widely used in the medicinal and food industry, therefore the study of its morphological parameters has important scientific and practical importance for determining a more promising direction. It was found that the seeds of plants of the genus *Nigella* differ in size and color. Detailed micromorphological studies made it possible to divide the investigated plant genotypes into the following morphogroups: with black color of the seed coat – *N. ciliaris, N. damascena, N. damascena* 'Risdviana zirochka', *N. sativa*; with brown color – *N. hispanica, N. orientalis, N. integrifolia, N. arvensis*. The seeds of some plants are used for food and medicine [24].

Seed geometry and size were strongly divergent between taxa [25]. Seed *N. orientalis* and *N. ciliaris* characterized by dorsoventrally flattened seeds more about 4 mm long and wide, with circular outline. Rest of taxa has smaller seeds a basically trigonous-ovate shape, with a single ventral ridge, and covered by an irregular reticulum different forms and colors. *N. ciliaris* lacks any secondary structure in seed surfaces, which gives them a shiny appearance (Fig. 2).

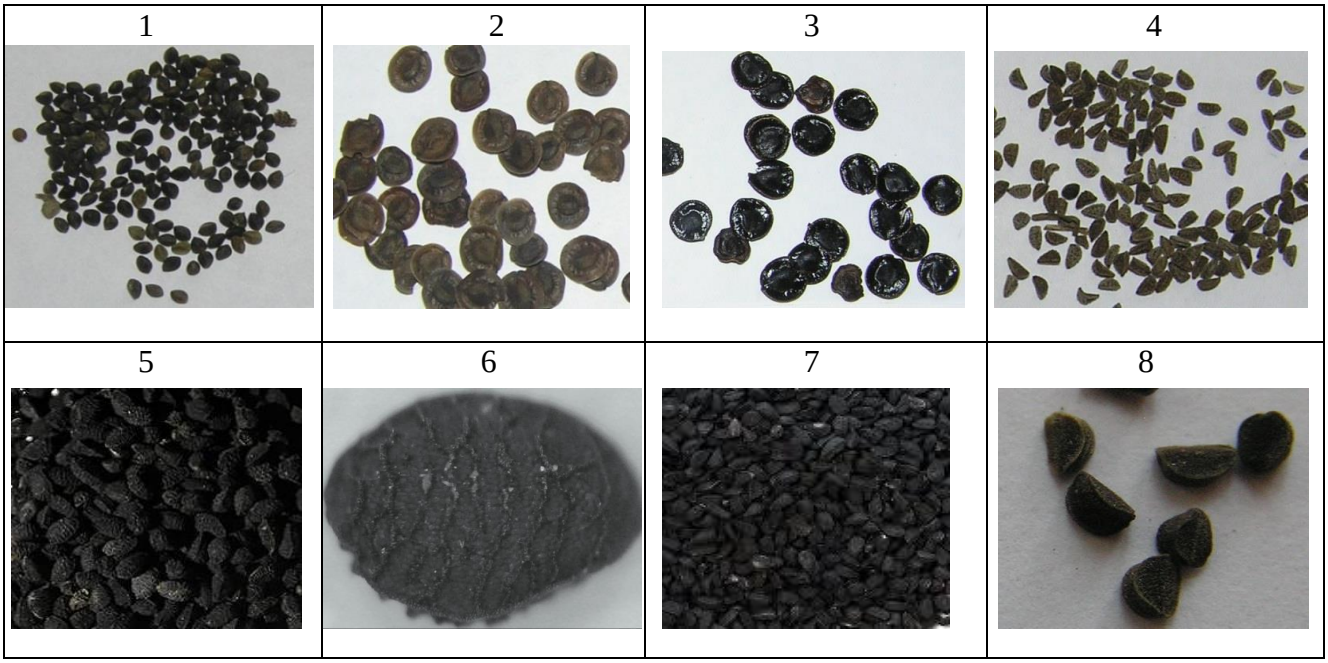


Figure 2. Seeds of plants of the *Nigella* genus: 1 – *N. hispanica*, 2 – *N. orientalis*, 3 – *N. ciliaris*, 4 – *N. integrifolia*, 5 – *N. damascena*, 6 – *N. damascena* 'Risdviana zirochka', 7 – *N. sativa*, 8 – *N. arvensis*

Leaves play an important role not only as the photosynthetic apparatus of plants, but also as one of the elements that determines the degree of decorativeness of a plant, since the size, color and density of their placement on the shoots are valuable features. The morphological features of the leaves of medial part of the main shoot were evaluated (Fig. 3).



Figure 3. Leaves of plants of the *Nigella* genus: 1 – *N. orientalis*, 2 – *N. hispanica*, 3 – *N. arvensis*, 4 – *N. damascena*, 5 – *N. sativa*, 6 – *N. nigellastrum*

Two morphogroups of leaves were identified: deeply pinnate with dense arrangement of lobes – *N. orientalis*, *N. hispanica*, *N. arvensis*, *N. damascena*, *N. integrifolia*, *N. sativa*; deeply pinnately dissected with sparse distribution of lobes – *N. nigellastrum*. The leaf segments are narrowly linear (*N. sativa*) to threadlike (*N. nigellastrum*).

In addition to the morphological differences of the above-mentioned organs of the studied plants of the Nigella genus, a difference in the size and features of the structure of the fruits was found depending on the genotype of the plants (Fig. 4).



Figure 4. Capsules of plants of the *Nigella* genus: 1 – *N. arvensis*, 2 – *N. hispanica*, 3 – *N. damascena*, 4 – *N. sativa*, 5 – *N. orientalis*, 6 – *N. nigellastrum*, 7 – *N. ciliaris*

Three groups are distinguished by the size of the capsules: large-fruited – *N. hispanica, N. damascena, N. orientalis*; medium-sized – *N. arvensis, N. sativa, N. ciliaris*; small fruits – *N. nigellastrum*. The fruits of species *N. hispanica, N. damascena, N. sativa, N. nigellastrum* is a inflated capsule composed some united follicles, each containing numerous seeds which are used as spice. The fruits of species *N. arvensis, N. orientalis, N. ciliaris* have a capsules with vertical, smooth, compressed oblong folicules, united at least to the middle for *N. arvensis, N. orientalis*, and separate – for *N. ciliaris*.

Thus, demonstrated the main external differences in the morphological structure of individual organs of plants of species and cultivars of the *Nigella* genus of the collection fund of the cultural flora department.

Conclusions

The collection fund of plants of the *Nigella* genus have been analyzed in this article, and the morphological features of the vegetative and generative organs of plants were clarified. This will make it possible to select the most important traits for the creation of high-performance genotypes of various uses in the future selection work.

A difference was significant so in the structure of flowers as leaves and seeds of all studied species. The number of petals in the flowers of plants of the genus *Nigella* varies from 5 in most studied species, and up to 27 – in the terry form of *Nigella damascena*.

In this way, the organs of the studied species have clear taxonomic characteristics, due to which the species cannot be confused.

The seeds of *N. damascena* have a sweet scent, slightly resembling those of strawberry. The seeds of *N. arvensis* and *N. sativa* have a pleasant smell of pepper so can be used by people as an energetically food additives, so as feed supplements for animals.The seeds of the remaining taxa are odorless, but this not affect to its other beneficial properties, which we plan to study in our future investigations of the plants *Nigella* genus.

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