Mobilization Of Genetic Resources Of *Hyssopus Officinalis* L. For Selection For Seed Productivity And Essential Oil Content

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MOBILIZATION OF GENETIC RESOURCES OF *HYSSOPUS OFFICINALIS* L. FOR SELECTION FOR SEED PRODUCTIVITY AND ESSENTIAL OIL CONTENT

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Abstract. We studied 52 varieties and breeding samples from the collection of medicinal hyssop in the Botanical Garden of Belgorod State University (2017-2020). Of these, 16 varieties of domestic selection included in the State Register of Breeding Achievements approved for use in the Russian Federation, as well as 33 breeding samples obtained by selection from wild cenopopulations of the Volokonovsky district of the Belgorod region and 3 breeding samples obtained by selection from local selection varieties 'Volokonovsky' (2 samples) and 'Lazar' (1 sample). As a standard for the evaluation of varieties and breeding samples in the collection nursery, the variety 'Volokonovsky ' was selected. The research was carried out in the framework of joint research programs with the federal research centers of the Russian Academy of Sciences: Williams Research Center for Forage Production & Agroecology, All-Russian Research Institute of Phytopathology. From the forms of various ecological and geographical origin, 11 breeding samples were identified: 2 varieties ('Volokonovsky'-CPI – 114, 'Lazar'-CPI – 126), and 9 selections from natural populations and varieties (CPI-03, CPI-04, CPI-28, CPI-29, CPI-30, CPI-31, CPI-32, CPI-33, CPI-34), which have a complex of useful features: long flowering (56-62 days), bush height-50-67 cm and dense structure of bushes; leafiness at the level of 60-67%. They are highly productive: the dry matter yield is 3.5-4.4 kg / m^2, the seed yield is 30.1-45.4 g*(m) $^{-2}$. At the same time, two breeding samples have a high level of essential oil content: CPI-33 – 0.67%, CPI-34 – 0.61%, which allows us to consider them as a source material for selection on this basis.
Keywords: source material, breeding characteristics, selection, seed yield, essential oil content.4

1. Introduction

Hyssop officinalis (*Hyssopus officinalis* L.) is introduced into the culture, is an important vegetable spicy-aromatic crop, honey-bearing, used in decorative construction [1,2].

Contains a number of valuable chemical components for the pharmaceutical industry. Hyssop species belong to the oldest medicinal plants known since the time of Hippocrates. The very species name H. *officinalis* L. indicates its valuable medicinal properties [3,4].

Hyssop essential oil is a complex of physiologically active substances that determines the significance and importance of individual forms and varieties of hyssop of various national economic significance [5,6]. In the last 10 years, the component composition of hyssop medicinal essential oil has been studied quite actively in various regions of Russia and the world [8-9].

Domestic and foreign authors actively discuss the problem of phylogeny, the creation of a new source material of hyssop, and its evaluation [10-14].

Work is underway to obtain forms that are characterized by a high content of biologically active substances, primarily antioxidants, as well as essential oils, which determine the value of varieties for industry [15-17].

The aim of the research was to assess the complex of economically valuable characteristics of the source material of hyssop officinalis, different in origin, in culture and to identify forms that are promising for selection by individual characteristics.

2. Methods and materials

We studied 52 varieties and breeding samples from the collection of medicinal hyssop in the Botanical Garden of Belgorod State University (2017-2020): 16 varieties of domestic selection included in the State Register of Breeding Achievements approved for use in the territory of the Russian Federation, as well as 33 varieties obtained by selection from wild cenopopulations of the Volokonovsky district of the Belgorod region and 3 varieties obtained by selection from the varieties ‘Volokonovsky’ (2 samples) and a new variety ‘Lazar’ (1 sample). As a standard for the evaluation of varieties and breeding samples in the collection nursery, the variety ‘Volokonovsky ' was selected.

Scientists from the federal research centers of the Russian Academy of Sciences: Williams Research Center for Forage Production and Agroecology, All-Russian Research Institute of Phytopathology participated in the joint research programs.

The study of samples of the collection of hyssop officinalis is conducted by standard methods developed for genetic and bioresource collections of medicinal and essential oil crops.

Biochemical studies were carried out according to standard methods. To prepare the average sample, phytomass was taken from 20 plants in 4-6-fold repetition. The separation of the essential oil and the identification of the individual components were carried out in the Center of Chemistry and Pharmaceutical Technology of the All-Russian Research Institute of Medicinal and Aromatic Plants. The yield of essential oil was determined in terms of absolutely dry matter (%). The obtained results were statistically processed [18].

3. Results and discussion

An important breeding feature is the duration of the flowering phase in breeding samples of hyssop officinalis. A longer period from the beginning of budding to full flowering is an important feature, because as a result, such plants enter the generative phase later than the standard, their green mass is slower to lignify. A longer flowering period is an important indicator for the use of varieties as a forage base for beekeeping. The range of variation of the trait was in the range from 35 to 60 days.

17 breeding samples (32.7 %) were selected in which the duration of the phase "beginning of regrowth-beginning of flowering" was from 56 to 62 days; 13 breeding samples (25.0 %), in which the height was from 50 cm to 67 cm; 16 breeding samples (30.8 %) with a dense structure(with high density); 13 breeding samples (25.0 %) in which the degree of leafiness varied in the range from 60 to 67 %.

The dry matter yield of H. *officinalis* breeding samples varied from 1.2 kg*(m) $^{-2}$ to 4.4 kg*(m) $^{-2}$. The first group included samples in which the dry matter value varied from 1.2 kg*(m) $^{-2}$ to 1.9 kg*(m) $^{-2}$. This group included 21 breeding samples (40.4 %). The second group included breeding samples, in which the dry matter value varied from 2.0 kg*(m) $^{-2}$ to kg*(m) $^{-2}$, 20 breeding samples (38.5%) were included. The third group included samples in which the dry matter value varied from 3.5 kg * (m) $^{-2}$ to 4.4 kg*(m) $^{-2}$ – 11 breeding samples (21.2%).

The seed yield of hyssop breeding samples varied from 16.1 g*(m) $^{-2}$ to 45.4 g*(m) $^{-2}$. The first group included breeding samples in which the seed yield varied from 16.1 g*(m) $^{-2}$ to 20.0 g*(m) $^{-2}$. This group included 14 breeding samples (26.9 %). The second group included breeding samples, in which the seed yield varied from 20.1 g*(m) $^{-2}$ to 30.0 g*(m) $^{-2}$, 24 numbers (46.2%) were included. The third group included breeding samples of hyssop officinalis, in which the seed yield varied from 30.1 g*(m) $^{-2}$ to 45.4 g*(m) $^{-2}$-14 breeding samples (26.29%).

For the Central Chernozem region, important breeding indicators are such resistance parameters as drought resistance, cold resistance, and winter hardiness. A score assessment of the stability parameters of hyssop breeding samples in the collection nursery was carried out.

The majority of hyssop breeding samples in the collection nursery – 86.5 % - had a fairly high drought resistance – at the level of 5 points. In 7 breeding samples of the collection – 13.5 % – the drought resistance was at the level of 4 points. 38 breeding samples had high cold resistance in the collection nursery, which was 73.1 % of their total number. The remaining 14 breeding samples (26.9%) had a cold resistance of 4 points.

The winter hardiness of breeding samples is an important indicator that determines the possibility of introducing new varieties and breeding samples of hyssop, the possibility of their stable seed propagation and distribution in the region. High winter hardiness in the collection nursery was demonstrated by 31 breeding samples, which accounted for 59.6 % of the total number. In 17 breeding samples of the collection (32.7%), the winter hardiness was at the level of 4 points. In 4 breeding samples of the collection (7.7%), the winter hardiness was at the level of 3 points.

The level of essential oil content in the raw material of the hyssop breeding samples studied in the collection nursery varied from 0.25% to 0.67% of dry matter (figure 1).

The first group included selection samples of H. *officinalis*, in which the content of essential oil in the raw material varied from 0.25% to 4.00%. This group included 27 selection samples (51.9%). The second group included selection samples of H. *officinalis*, in which the content of essential oil in the raw material varied from 4.01% to 4.99%; 10 selection samples (19.2%) were included. The third group included breeding samples of H. *officinalis*, in which the content of essential oil in the raw material exceeded 5.00% - 15 breeding samples (28.8%).

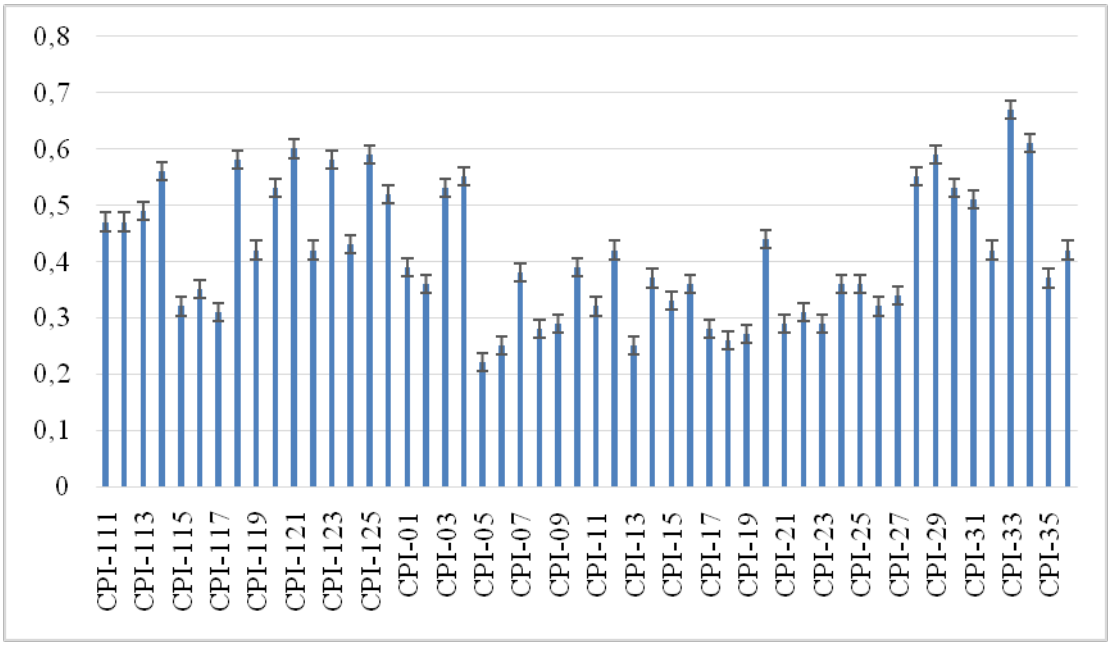

Figure 1. Content of essential oil in raw materials of selected selection samples from the collection of H. *officinalis*

4. Conclusion

1. From forms of various ecological and geographical origin, 11 selection samples were isolated: 2 varieties ('Volokonovsky' - CPI-114, 'Lazar' - CPI-126), and 9 selections from natural populations and varieties (CPI-03, CPI-04 , CPI-28, CPI-29, CPI-30, CPI-31, CPI-32, CPI-33, CPI-34), which have a set of useful traits: long flowering (56-62 days), bushes height - 50 -67 cm and dense structure of bushes; foliage at the level of 60-67%. They are distinguished by high productivity: the yield of dry matter is 3.5-4.4 kg * (m) $^{-2}$, the yield is 30.1-45.4 g * (m) $^{-2}$. These selection samples were submitted for further selection testing.

2. Two breeding samples - CPI-33 - 0.67%, CPI-34 - also have a high level of essential oil content - 0.61%, which allows us to consider them as a source material for breeding on this basis.

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