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Comparative Analysis of Common Fennel Regenerants Pabout the Main Morpho-Biological Features Basedon And

Meliboeva Sh. Sh.
Bukhara State Medical Institute, Bukhara, Republic of Uzbekistan

Abstract: *Common fennel (Foeniculum vulgare Mill.) belongs to the Celeryfamily (Apiaceae). It is cultivated mainly for the production of essential oil, which is isolated from the seeds and green mass of the plant. In addition to essential oil, fennel fruits contain fatty oil and protein, so they are widely used in the perfume, cosmetics and food industries. Currently, breeding work is continuing aimed at increasing the yield and mass fraction of essential oil in fruits and green raw materials of this crop. In addition to traditional approaches, biotechnological methods are used to obtain the initial breeding material. It was found that all samples had a plant height of 146.7 to 168 cm, a lower umbrella attachment height of 79.7 to 94 cm, and were suitable for mechanized harvesting.*

Keywords: *Foeniculum vulgare, regenerating plants, mass fraction of essential oil.*

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Introduction. Fennel has been known as a medicinal herb since ancient Rome, and fennel essential oil and "fennel water" (distilled water obtained by distilling oil with water vapor) have been used in medicine since the beginning of the XVI century [1]. Fennel is native to the Mediterranean countries. Common fennel (Foeniculum vulgare Mill.) belongs to the Celeryfamily (Apiaceae). It is a perennial herbaceous plant with a height of 1-2 m. Fennel is cultivated mainly for the production of essential oil, the main components of which are anethole (C10H12O) (60-80%), fennel (2-22%), methylhavicol (3-15%).In addition to essential oil, fennel fruits contain 16-20% fat oil and up to 22% protein [2]. Fennel fruits and essential oil are widely used in the perfume, cosmetics and food industries. In medicine, fennel is used for atony of the digestive tract, flu, stomach pain, to increase lactation of nursing mothers and to prepare "dill water" [3]. Essential oil can be obtained both from the fruit and from the green mass of fennel. Currently, the Institute continues breeding work aimed at increasing the yield and mass fraction of essential oil in fruits and green raw materials. It is known that in recent decades, biotechnological techniques have been used to improve the efficiency of breeding and create new genotypes of agricultural plants [4, 5, 6, and 8]. One of these methods of cell engineering is the induction of somaclonal variability, based on the high genetic heterogeneity of callus or suspension cultures. Such cellular technologies are also being developed for some essential oil plants – such as lavender, sage, coriander, and essential oil geranium [15, 16, and 17]. The analysis of regenerantsobtained from the calli of these plant species revealed somaclonal variants with changes in some morphological and economically valuable traits, as well as identified promising samples that exceed the original varieties in yield and essential oil collection. The most important aspect in creating biotechnologies for obtaining initial breeding material is the study of regenerating plantspe by morphology and economic characteristics in the field to identify

somaclonal features variations and valuable forms for further breeding work. The aim of the study was to compare the main morpho-biological and economically valuable traits регенерантовof fennel regenerants obtained in in vitro from callus cultures of the varietyMertsishor. Materials and methods of research Regenerating plantsрегенерантыwere induced from callus tissues of the first passage obtained from explants of the variety's stemMertsishor. Previously developed techniques were used to initiate embryogenic callus, regenerate plants in in vitro, and adapt them in in vivo [26, 27, 28, and 30]. This region belongs to one of the five agroclimatic regions – upper foothill. The climate of the zone is arid, most often with mild winters. The average annual air temperature is 10 °C. The maximum air temperature reaches 38 °C, and sometimes 40 °C. The minimum temperature in winter averages -18 °C, sometimes -25 °C. The average annual precipitation is 531 mm. The sum of active temperatures above 10 °C is 2800-3300 °C [28, 31]. In general, the weather conditions in the research area are quite stable. In different years, there may be some deviations from the long-term average indicators, which affect the development of plants cultivated in this area. The length of the accounting plot is 1 m; with row spacing of 0.6 m. Seeds were sown manually in 50 pieces per 1 m. The experience is repeated twice. The content of the mass fraction of essential oil (MDEM) was determined by hydro distillation [19]. Experimental data were processed by the method of variance analysis [20, 22]. Results and discussion Previously, as a result of experiments, nutrient media for obtaining callus tissues and inducing somatic organogenesis from them were selected, and methods for long-term plant regeneration for a number of fennel varieties were developed [16,17]. In Regenerates of Ro obtained in vitro from callus of the first passage регенеранты Ропослеадаптации in vivo were transferred to the field after in vivo adaptation, and the resulting seed progeny (R1) were studied for various economic characteristics. Winter hardiness was determined in the spring at the beginning of the growing season by the degree of damage to plants in accounting plots after overwintering. Analysis of regenerates for the duration of the growing season showed that all samples matured 7-9 days later than varieties and had a growing season duration of 137-140 days. All regenerates are suitable for mechanized harvesting, since they had a height of The height of attachment of the lower umbrella in regenerate plants varied from 79.7 cm (in sample R 812-34) to 94 cm (in R 812-20), in varieties – 74.7 cm and 66.3 cm (Mertsishor). The number of shoots of the first order is one of the important indirect indicators used in determining the productivity of fennel. The range of variability of this indicator in the studied regenerants is quite large-from 5.9 pcs. Sample 812-20 has up to 8.6 pcs. Sample 812-16, variety Mertsishor – 6.9 pcs. and u-6.6 pcs. During the period of full flowering, the content of essential oil in fresh raw materials and the yield of green mass were determined. According to the yield of green mass, all regenerants significantly exceeded the original variety Mertsishorand were at the level of the last zoned variety, and samples 812-11 and 812-21 exceeded the latter by 30.8 and 43.7 c / ha, respectively, but even this increase slightly affected the collection of essential oil, and in varieties the value of this trait was higher. These samples are of interest for further breeding work as sources of high yield. In terms of collecting essential oil from green raw materials, most of the analyzed samples were inferior to varieties. Only in three samples – 812-12, 812-21, 812-22-the values of this indicator did not significantly differ from the varieties. In the course of the work, the yield of fruits from accounting plots, the mass of 1000 seeds were calculated, the content of essential oil in fruits was analyzed, and the oil collection was calculated. It can be noted that all regenerants were in fortiori seed yield to varieties. According to MDEM, a wide range of variability was found in fruits – from 5.38% in sample 812-33 to 7.60% in sample 812-35. Samples 812-34 and 812-35 with an essential oil content of 7.15 and 7.60%, respectively, did not differ significantly from the varieties. The content of essential oil in the varieties was 7.83% and 7.65%, respectively. Thus, in the analysis of regenerated plants obtained from the callus tissues of fennel varieties, the variability of certain characteristics according to the Agrarian Science was established and samples exceeding the original variety in terms of green mass yield were identified, which indicates the prospects for

using forms obtained using biotechnological methods as the initial breeding material. In the literature, one can find rather contradictory data on the study of regenerants from isolated fennel crops. So, in work A. Bennici et al. demonstrated the genetic stability of fennel regenerants [21]. On the other hand, French researchers, using plants obtained in vitro by somatic embryogenesis and the classical method of hybridization, were able to increase the yield of this type of essential oil plant by five times [22]. Conclusions It was foundthat all regenerates are suitable for mechanized harvesting, had a plant height from 146.7 cm (in sample 812-5) to 168 cm (in 812-12) and the height of attachment of the lower umbrella – from 79.7 cm (in 812-34) to 94 cm (in 812-20). Regenerates 812-10, 812-11, and 812-20 had good winter hardiness (5 points on average for all years of the study) and can be used as sources of this trait in further breeding work. All the studied samples exceeded the grade in terms of green mass yield Mertsishor and were at grade level Oxamit Samples 812-11 and 812-21 exceeded it by 30.8 c / ha and 43.7 c/ha, respectively. A wide range of variability in the mass fraction of essential oil in regenerant seeds is established – from 5.38 to 7.6%. Samples 812-34 and 812-35 with a high essential oil content of 7.15 and 7.6%, respectively, were isolated. Regenerants 812-11, 812-35 are of interest for subsequent breeding as sources of individual valuable traits – winter hardiness, yield, and essential oil content.

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