

Evaluation of oregano (*Origanum vulgare* L.) accessions by complex of functional traits

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Abstract. During 2012–2020, 44 oregano (*Origanum vulgare* L. ssp. *vulgare*) accessions had been described at the *ex situ* collection of aromatic and medicinal plants (N 56°39'45.3"; E 23°45'15.2), located at the Latvia University of Life Sciences and Technologies. The accessions were evaluated for morphological traits, growth and yield parameters, phenological properties, biochemical indices, plant resistance to diseases and pests, winter hardiness etc., using international Draft Descriptor List *Origanum vulgare* L. In our study, multi-criteria analysis was used to assign an overall value to each plant material as well accessions were grouped by complex of functional traits. In total, eleven accessions No. 2, 3, 12, 14, 17, 18, 24, 28, 29, 43 and 44, which had high evaluation of morphological and phenological properties, yield components, resistance to diseases and pests as well as winter hardiness, have the best growing potential in commercial plantations. Accessions No. 3, 9, 11, 14, 17, 23, 24, 26, 35 and 42, which were characterised by rare and unique morphological indices, high winter hardiness as well as resistance to diseases and pests, have the best potential as ornamentals. Accessions No. 23, 29 and 41 were selected as the best for food because of specific parameters, including yield's quality (especially by content of C vitamin). Grouping or oregano accessions by complex of functional traits is important for selection the most valuable of them with specific features needed for cultivation, processing and trade.

Keywords: oregano, accessions, variability, traits.

I. INTRODUCTION

Oregano (*Origanum vulgare* L.) is multifunctional aromatic and medicinal plant that has been utilised in folk medicine for thousands of years in the Baltic countries [1].

Nowadays, fresh, dry or processed, oregano is widely used in culinary, medicine, veterinary medicine, pharmacy, aromatherapy, cosmetics, fragrance industry, floristics and decoration etc. [2]. By European Cooperative Programme for the Plant Genetic Resources, oregano is defined as one of priority species of aromatic and medicinal plants [3]. In Europe, including Latvia, wild populations of oregano are severely depleted because of the wide use of raw material. That is why cultivation of oregano is important for keeping a local genetic resource of oregano as well as for meeting the needs of herbs' production. Depending on marketing needs, productivity of oregano accessions can be evaluated by different criteria. For cultivation, food or ornamental horticulture, oregano accessions with specific valuable indices should be selected.

This study aimed to perform multi-criteria analysis to assign an overall value to oregano accessions from the *ex situ* collection of genetic resources as well as to group them by the complex of functional traits.

II. MATERIALS AND METHODS

During long-term investigations (2012–2020), plant material of 44 oregano (*Origanum vulgare* L. ssp. *vulgare*) accessions from the *ex situ* collection of aromatic and medicinal plants (N 56°39'45.3"; E 23°45'15.2'), located at the Laboratory of Horticulture and Beekeeping, Institute of Soil and Plant Sciences, Faculty of Agriculture and food technology, Latvia University of Life Sciences and Technologies, was described. Initially, during 2001–2006, accessions were collected from local natural habitats in different regions of Latvia [4]. During the investigations in *ex situ* collection, the accessions were evaluated for morphological traits, growth and yield parameters, phenological properties, biochemical indices, plant resistance to diseases and pests, winter hardiness etc., using Draft Descriptor List *Origanum vulgare* L., prepared by the European Cooperative Programme for Plant Genetic Resources [5].

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In this study, multi-criteria analysis was used to assign an overall value to each plant material [6]. The formula was used:

$$SD = \sum_{i=1}^N \omega_i (I_i - x_{vid, i}) / S_d \quad (1)$$

Where:

SD – value of accession;

i – quantitative feature;

I_i – desired feature value of trait;

$x_{vid, i}$ – actual value of trait;

ω_i – feature contribution coefficient;

S_d – standard deviation;

N – count of traits.

Low value of accession indicates that the genotype is closer to the desired traits.

By the suitability for cultivation in commercial plantations, ornamental horticulture or food, plant material was evaluated according to the desired characteristics, important for achieving a certain goal. Accessions were grouped by complex of functional traits, using the received data of multi-criteria analysis.

For **cultivation in commercial plantations** (including for pharmaceutical purposes), the suitability of oregano accessions was evaluated according to 16 traits, N = 16. Traits were divided into 4 groups:

- morphology (ω_i 20%): erect habitus, plant height >50 cm, count of stems >100 stems per plant, count of internodes from the soil level till the inflorescence <5, length of inflorescence at least ½ from total plant height, width of inflorescence >10 cm, dense flowering;
- phenology (ω_i 20%): early (before 2nd decade of June) or late (later than 3rd decade of July – start of August) full flowering, duration of flowering longer than 40 days;
- yield and yield quality (ω_i 30%): fresh biomass >500 g per plant, dry biomass at least 30% fresh biomass), relatively higher content of essential oils and C vitamin;
- resistance to adverse conditions (ω_i 30%): high winter hardiness (0-4% of plants are damaged or dead), no visible symptoms caused by pests or diseases.

For **ornamental horticultural needs** (including cultivation in rock gardens, containers, kitchen garden), the suitability of oregano accessions was evaluated according to 13 traits, N = 13. Traits were divided into 4 groups:

- morphology (ω_i 25%): prostrate habitus, plant height <25 cm, count of internodes from the soil level till the inflorescence <5, dense foliage and dense flowering, unique color of petals (for example, white);
- phenology (ω_i 20%): different flowering period, duration of flowering longer than 40 days;

- yield and yield quality (ω_i 20%): relatively higher content of essential oils, relatively higher content of phenolic monoterpenes (indicates an expressive aroma);
- resistance to adverse conditions (ω_i 35%): high winter hardiness (0-4% of plants are damaged or dead), no visible symptoms caused by pests or diseases.

For **food** (including salad recipes), the suitability of oregano accessions was evaluated according to 9 traits. Traits were divided into 4 groups:

- morphology (ω_i 15%): count of stems >100 stems per plant, dense foliage, intensive green color of leaves;
- phenology (ω_i 10%): early start of vegetation;
- yield and yield quality (ω_i 40%): fresh biomass >500 g per plant, relatively higher content of C vitamin;
- resistance to adverse conditions (ω_i 35%): high winter hardiness (0-4% of plants are damaged or dead), no visible symptoms caused by pests or diseases.

III. RESULTS AND DISCUSSION

In total, eleven accessions No. 2, 3, 12, 14, 17, 18, 24, 28, 29, 43 and 44, with high evaluation of morphological and phenological properties, yield components, resistance to diseases and pests as well as winter hardiness, have the best growing potential in commercial plantations (Fig. 1). Accession No. 29 (SD = 1.32) can be defined as the most valuable. Also, for accessions No. 12, 24 and 7 the value of SD was not higher than 2, respectively 1.58, 1.84 and 1.99.

Accessions No. 3, 9, 11, 14, 17, 23, 24, 26, 35 and 42, which were characterised by rare and unique morphological indices, high winter hardiness as well as resistance to diseases and pests, have the best potential as ornamentals (Fig. 2), SD was from 3.00 till 4.00. For other accessions, SD was not higher than 5, excluding No. 1, 2, 16, 22 and 43 (SD was from 5.00 till 6.00).

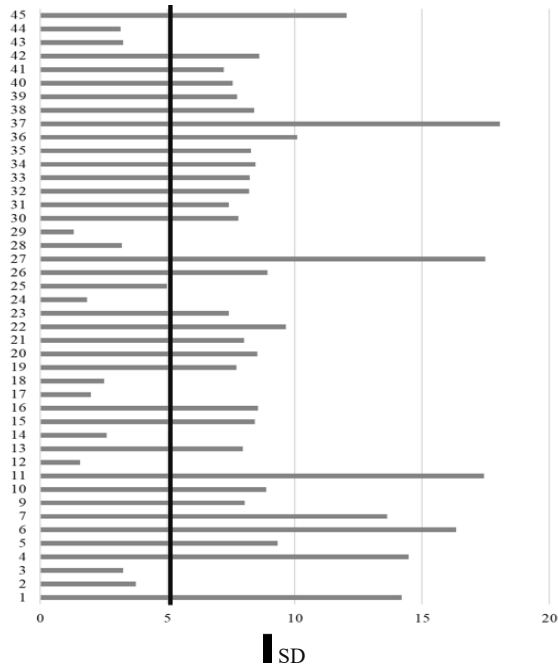


Fig. 1. Evaluation of oregano accessions by suitability for commercial cultivation.

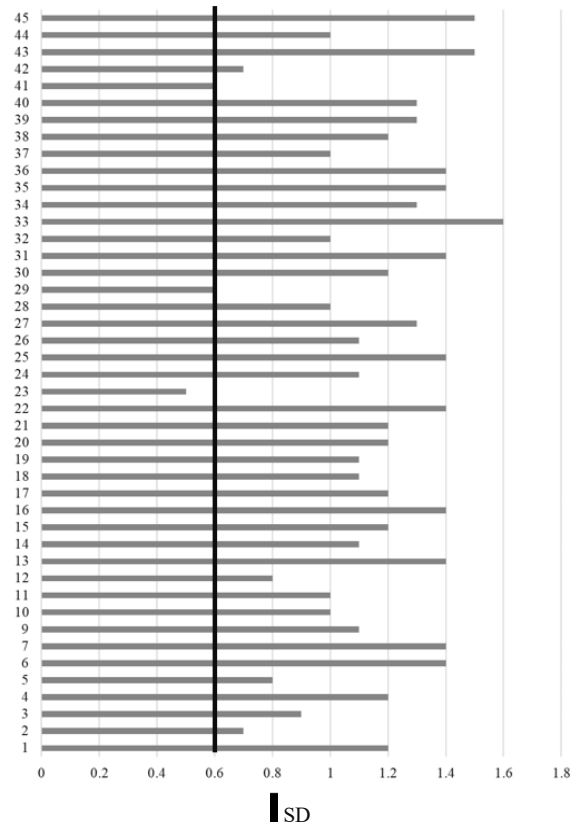


Fig. 3. Evaluation of oregano accessions by suitability for food.

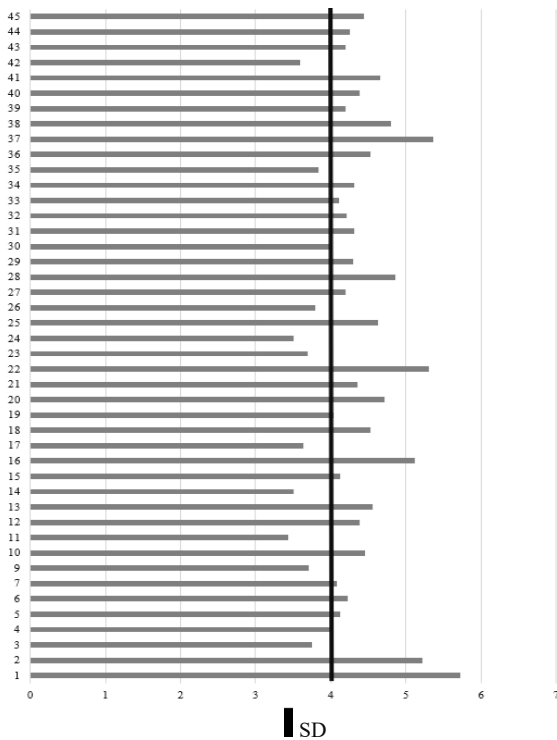


Fig. 2. Evaluation of oregano accessions by suitability for ornamental horticulture.

Accessions No. 23, 29 and 41 (SD was till 0.6, for No. 29 SD = 0.5) were selected as the best for food (Fig. 3), especially because of the content of C vitamin. By these indices, accessions No. 2, 5, 12, 42 ad SD respectively 0.7, 0.8. 0.8 and 0.7.

In scientific literature, there is a lack of information about the use of multi-criteria analysis for evaluation the productivity of horticultural crops, including aromatic and medicinal plants. As well as only some research works present data about the differences between oregano accessions. Usually, only some quantitative and qualitative indices are compared [7] – [9]. Mostly, all described morphological or chemical indices are economically important indicators for selecting accessions suitable for cultivation [4], [7] – [10]. But for oregano, the indicators of productivity can be very specific, depending on marketing needs. By Kampuss, method of multi-criteria analysis can help to select accessions by a group of criteria, including the cases, that these criteria cannot be compared with each other [6]. Method of multi-criteria analysis is convenient; it can be used when for different measures separate scales should be used. Also, it is possible to group these features as well as to assign a significance coefficient to an individual characteristic or a group of characteristics.

IV. CONCLUSIONS

Multi-criteria analysis can be used for evaluation of plant material from *ex situ* collection. Grouping of oregano accessions by complex of functional traits is important for selection the most valuable of them with specific features needed for cultivation, processing and trade.

REFERENCES

[1] A. Asdal, Ed., Spice- and medicinal plants in the Nordic and Baltic Countries. Conservation of genetic resources. Alnarp: Nordic Gene Bank, 2006.

- [2] A. Azizi, F. Yan and B. Honermeier, "Herbage yield, essential oil content and composition of three oregano (*Origanum vulgare* L.) populations as affected by soil moisture regimes and nitrogen supply," *Ind. crops and prod.*, vol. 29, pp. 554–561, 2009.
- [3] I. Žukauska, "Garšaugu ģenētiskie resursi Latvijā," *Agron. Vēst.*, No. 10, pp. 241–247, 2008.
- [4] I. Sivicka, "Ecological assessment of wild populations and *ex situ* conservation of genetic resources of oregano (*Origanum vulgare* L.) in Latvia," *Ecol. & Saf.*, vol. 6, part 1, pp. 254–260, 2012.
- [5] I. Žukauska and I. Sivicka. Draft Descriptor List *Origanum vulgare* L. Rome: ECPGR, 2011.
- [6] K. Kampuss, "Upeņu un jāņogu (*Ribes* L.) ģenētisko resursu izpēte Latvijā," Dr. thesis, Latvijas Lauksaimniecības universitāte, Jelgava, Latvia, 2005.
- [7] O. Kosakowska and W. Czupa, "Morphological and chemical variability of common oregano (*Origanum vulgare* L. subsp. *vulgare*) occurring in eastern Poland," *Herba Pol.*, vol. 64, No.1, pp. 11–21, 2018.
- [8] R. Nurzýnska-Wierdak, "Herb yield and chemical composition of common oregano (*Origanum vulgare* L.) essential oil according to the plant's development stage," *Herba Pol.*, vol. 55, No. 3, p. 55–62, 2009.
- [9] Z. Węglarz, O. Kosakowska, J. Przybył, E. Pióro-Jabrucka and K. Bączek, "The quality of greek oregano (*O. vulgare* L. subsp. *hirtum* (Link) Ietswaart) and common oregano (*O. vulgare* L. subsp. *vulgare*) cultivated in the temperate climate of Central Europe," *Foods*, vol. 9, 1671, 2020.
- [10] A. Azizi, "Genetic, chemical and agro-morphological evaluation of the medicinal plant *Origanum vulgare* L. for marker assisted improvement of pharmaceutical quality," Dr. thesis, Justus Liebig University, Giessen, Germany, 2010.