RESEARCH OF OREGANO (*ORIGANUM VULGARE* L.) INFLORESCENCE`S PARAMETERS

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Abstract
Oregano (*Origanum vulgare* L.) is one of the most popular spice and medicinal plants of untraditional horticulture in Latvia. Wild populations of this plant are too few. That is why it is necessary to cultivate oregano for keeping the biodiversity of Latvian nature. It is important to use local oregano genetic resources in agrocenosis as well as to get as rich and qualitative yield as possible. The aim of this research was to explore the parameters of oregano inflorescence in Latvia and to recommend the most productive clones for cultivation. In summer 2011, a total of 45 oregano clones from an *ex situ* collection of spice and medicinal plants of the Laboratory of Cultivated Plants and Apilogy (Jelgava, Strazdu Street 1) were analysed. Such inflorescence parameters as length and width were explored. The average length of inflorescence of all clones was 17.99 cm, and the average width was 5.74 cm. The results showed that the clone No 26 had the largest width of inflorescence (9.6 cm), but the clone No. 2 had the largest length of inflorescence (31.1 cm). Using oregano Draft Descriptor List, the inflorescence was characterized as short, medium or long. The variability between clones was significant ($p<0.05$), but between samples of each clone - non-significant ($p>0.05$). It is recommended to grow oregano clones No. 2, 5 and 26 in agrocenosis as the most productive.
Key words: length of inflorescence, width of inflorescence, plant height.

Introduction

Oregano (*Origanum vulgare* L.) is classified as a medicinal, spice and ornamental plant (Hammer and Spahillari, 2000). It is one of the most popular plants of untraditional horticulture in Latvia. Besides, it is a paramount medicinal and aromatic plant in Europe (Asdal et al., 2009). Oregano is used in production of essential oil, in medicine, perfumery, culinary, food and beverage production, aromatherapy, for attracting bees. Historically the Latvians used oregano as an ingredient in production of sausages (Spice- and..., 2006). Oregano has been utilized in folk medicine for thousands of years in the Baltic countries. In Latvia, oregano tea is traditionally used against hangovers. Oregano has also been used in sauna switches composition and its extract - for bathing.

'Herba origani' is the inflorescence (flowering top of the herb). If oregano is used in medicine, plants should be cut at the date of full flowering. If it is used as a spice, plants should be cut at the beginning of flowering or in the flower bud stage.

Wild populations of oregano in Latvia are too few (Baricevic, 2010). It is important to cultivate oregano for keeping the biodiversity of Latvian nature. The local genetic resources are adapted to concrete climate conditions and possible stress situations in a specific environment, which is why it is necessary to use Latvian oregano clones in agrocenosis (The international…, 2001). Oregano cultivation needs to get as rich and qualitative yield as possible. Oregano local genetic resources have to be explored with the aim to select the most valuable clones.

The inflorescence is the productive part of oregano plants. The evaluation of inflorescence`s parameters is the basis for oregano selection. The aim of this research was to explore the parameters of oregano inflorescence in Latvia and to recommend the most productive clones for cultivation.

Materials and Methods

Plant Material and Growing Conditions

The samples for experiment were selected from an *ex situ* collection of spice and medicinal plants (latitude: N 56°39′47″; longitude: E 23°45′13″). It is a fundamental collection in Latvia, attached to the Laboratory of Cultivated Plants and Apilogy (Jelgava, Strazdu Street 1).

There are 120 clones of 13 species of spice and medicinal plants in this collection. In 2001-2006, thanks to various international projects, the genetic resources of oregano from different places of Latvia were added to this collection. The plants had been collected from nature using the method of professor E. Muižarāja (Žukauska, 2008). The main point of this method is the initial visual division of an area into squares and zigzag passing through these squares, as well as the random gathering of accessions. The oregano collection was planted in 2008 and reconstructed in 2009.

For the year 2012, in the *ex situ* collection there are 45 clones of oregano, planted in three rows, each clone in three repetitions. The clones are in random order. In the process of selection of wild clones, the latitude and longitude was registered, the topographic description of places as well as the morphological description of plants was made. All these data are registered in the system of Nordic Gene Bank.

Soil at the trial site was strongly altered by cultivation loam with organic matter content of 2.7 g kg^{-1}, soil reaction was slightly acidic (pH KCl - 6.3), P content was 102 mg kg^{-1} and K content was 207 mg kg^{-1}. Plant care (weeding,

watering, fertilizing) was provided for the *ex situ* collection.

For experiment in summer 2011, a total of 10 stems per each of 45 oregano clones (in total 450 samples) were cut from the ground level to the tip of the plant at the beginning of flowering. The samples were dried at +26 °C temperature in a special drying cabinet with ventilation. After 3 weeks the length and the width of inflorescence were measured. According to Draft Descriptor of oregano, the inflorescence can be short (less than ½ of plant heigt), medium (½ of plant height) or long (more than ½ of plant height). That is why for better analysing of the length of inflorescence the data on plant height were recorded (Žukauska and Sivicka, 2010). Figure 1 shows some parameters of oregano: plant height and the length and width of inflorescence.

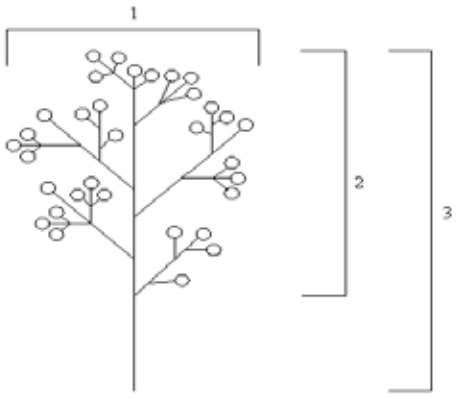

Figure 1. Oregano plant parameters:
1- width of inflorescence, 2- length of inflorescence,
3 - plant height.

Meteorological conditions

According to data of the Latvian Environment, Geology and Meteorology Centre, the average air temperature in 2011 was +7.3 °C (1.6 degrees above long-term average observations), and the quantity of rainfall was 690 mm (4% above long-term average observations). The snow cover during all winter months was thick that year. After close to normal spring, June and July were the second warmest months in the last 88 years in Latvia, but according to the data of observation stations, the rainfall in summer was more than 4-5 times above long-term average observations for this period. From 31 May to 12 June (after plant cutting), the average air temperature was 8-9 degrees above long-term average observations. The average air temperature in summer was +18 °C. In the period of plant cutting, weather conditions were stable warm, about 6-8 degrees above long-term average observations. Twelve days in the period from June to August were very hot, and the air temperature exceeded +30 °C (Weather..., 2011).

In scientific literature, it was proved that during the vegetation period the influence of air temperature from +20 to +30 °C and of the quantity of rainfall of about 600 mm on oregano yield components is positive (Caliskan et al., 2010; Rzekanowski et al., 2008). In total, in 2011 the meteorological conditions were appropriate for oregano cultivation and plant biomass creation.

Results and Discussion

The length and the width of inflorescence are the most important parameters of oregano productivity. The data about the length of inflorescence of samples from the *ex situ* collection are presented in Table 1.

The results showed that the average length of inflorescence of 2 clones was more than 30 cm (the most productive clones), it was less than 10 cm for 3 clones (the less productive clones), 13 clones had the inflorescence from 20 to 30 cm, 27 clones - from 10 to 20 cm. The average length of inflorescence of all clones was more than 15 cm (i.e. 17.99 cm) which is good result. The clone No. 2 had the largest average length of inflorescence (31.1 cm). The data statistical analysis showed that the variability between clones was significant ($p<0.05$), but between samples of each clone it was non-significant ($p>0.05$).

In 2006, oregano clones from Latvia, Lithuania, Estonia and Norway were described using Descriptor list for *Origanum vulgare* L. (Spice- and..., 2006). The average length of inflorescence for all countries was more than 15 cm (i.e. 23.2 cm in Estonia, 22.5 cm in

Table 1

Oregano length of inflorescence on average, cm

Interval	Minimum	Maximum	Clone number
Less than 10	1.5	20.5	16, 33, 39
10 - 20	2.2	48.1	1-4, 6, 7, 9, 11, 13-15, 17, 19, 20, 22, 24, 27, 29, 31, 32, 34-36, 38, 40, 41, 43, 44
20 - 30	4.0	54.0	8, 10, 12, 18, 21, 23, 25, 26, 28, 30, 37, 42, 45
More than 30	13.0	52.2	2, 5

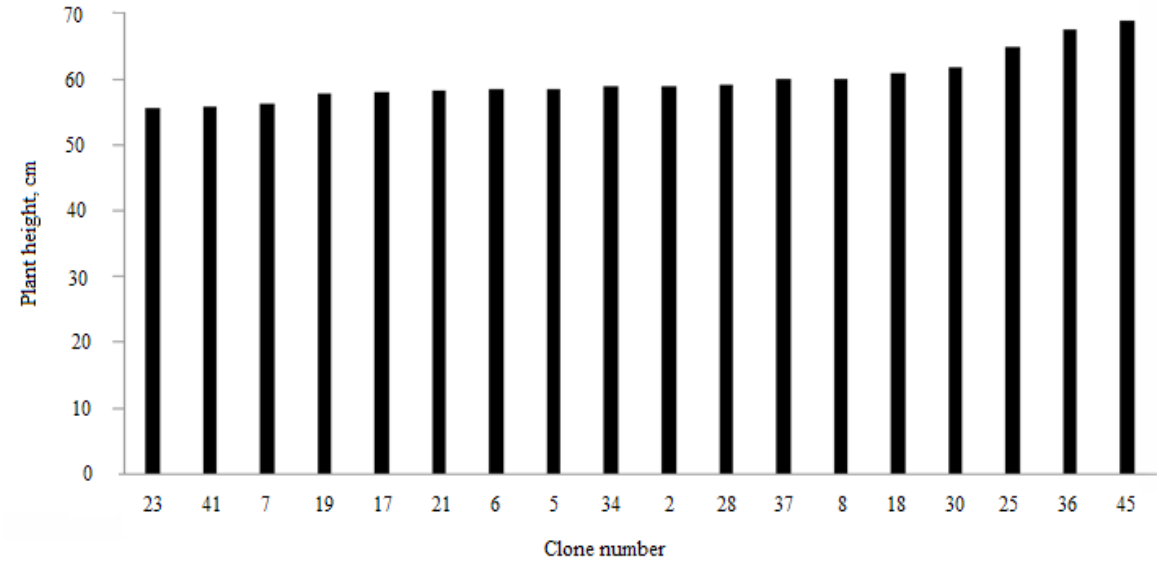

Figure 2. Plant height of most productive oregano clones on average, cm.

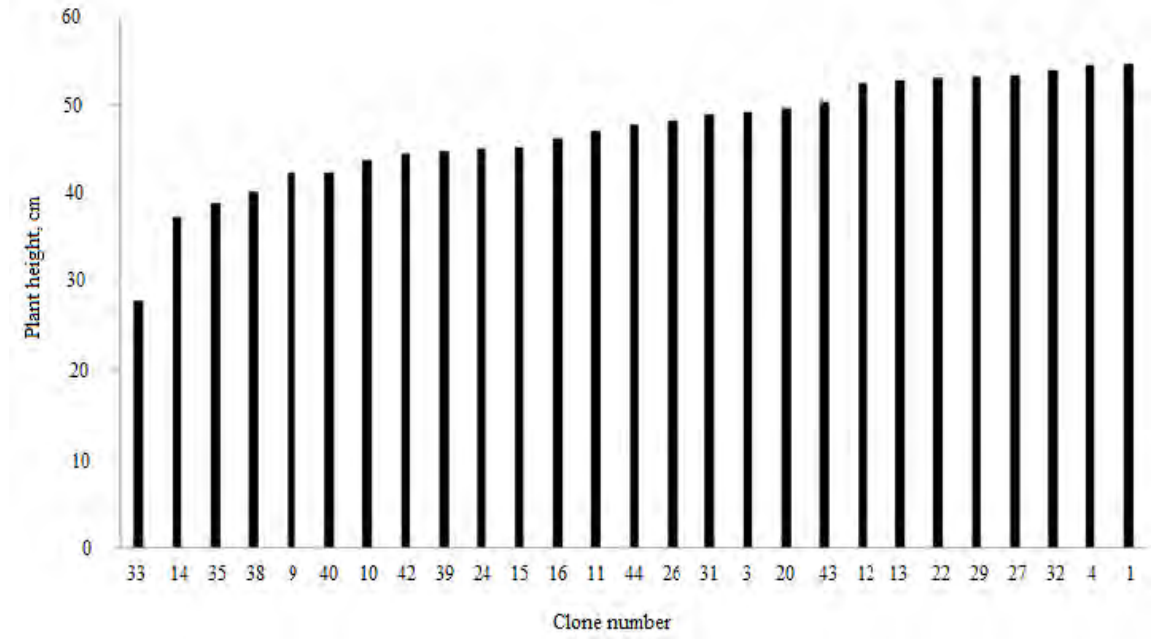

Figure 3. Plant height of less productive oregano clones on average, cm.

Latvia, 19.8 cm in Lithuania, and 15.7 cm in Norway). Besides, the result in Latvia in 2006 was better than in 2011 (17.99 cm).

For better analysis, the data about plant height were recorded, and the results showed that it varied from 27.9 to 68.9 cm. The most productive were clones with the plant height from 55 cm and higher (Figure 2).

The less productive were clones with the plant height from 27.87 cm to 55 cm (Figure 3).

The length of inflorescence was compared with the plant height. Using oregano Draft Descriptor List, it was characterized as short, medium or long (Table 2).

Table 2

The characteristics of length of inflorescence

The length of inflorescence	Clone number
Short (less than ½ of plant height)	1, 3, 4, 6-25, 27-45
Medium (½ of plant height)	None
Long (more than ½ of plant height)	2, 5, 26

The results demonstrated that only 3 clones had long inflorescence, but all the others had short inflorescence. In agrocenosis it is necessary to

cultivate plants with long inflorescence in order to obtain a higher oregano yield. Table 3 presents data about the width of inflorescence of oregano clones.

Table 3

The width of inflorescence on average, cm

Interval	Minimum	Maximum	Clone number
Less than 5	1.2	8.9	15, 16, 20, 34, 38-40, 44
5 - 7	1.0	16.2	1, 4, 6-12, 14, 15, 17-19, 21-25, 27-33, 35-37, 41-43
More than 7	1.5	14.5	2, 3, 5, 13, 26, 45

The results showed that the average width of inflorescence of 6 clones was more than 7 cm (the most productive clones), 31 clone had the width from 5 to 7 cm, but for 8 clones it was less than 5 cm (the less productive clones). The average width of inflorescence of all clones was less than 10 cm (i.e. 5.74 cm), that is bad result. The data statistical analysis revealed that variability between the clones was significant ($p<0.05$), but between samples of each clone - non-significant ($p>0.05$).

In 2006, the average width of inflorescence was 13.6 cm in Estonia and Latvia, 12.1 cm in Lithuania and 6.1 cm in Norway (Spice- and…, 2006). In 2011, the result of Latvia was worse (5.74 cm).

To sum up all the results, the most valuable were the clones Nos. 2, 5 and 26. Their productive part (inflorescence) had the most optimal parameters of length and width. It is necessary to continue this research with the aim to explore the changes in oregano inflorescence`s parameters through the years.

In future, an additional task is to study the changes in the content and composition of essential oil in the vegetation period (Nurzynska-Wierdak, 2009; Radušiene et al., 2005). To evaluate the importance of these clones as a source of essential oils with culinary and medicinal value, it is necessary to investigate more thoroughly the actual ingredients in each example (Lukas et al., 2011; Иванов, 2011). It is important to continue the research of oregano morphology and biochemistry. In this way, it will be possible to cultivate oregano clones with optimal parameters of inflorescence and with the richest biochemical content.

Conclusions

Such parameters as the length and width of inflorescence, as well as characteristics of the length of inflorescence of 45 oregano clones had been explored in Latvia. It is recommended to grow oregano clones Nos. 2, 5 and 26 in agrocenosis as the most productive ones.

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