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EXPERIMENTAL PAPER

Morphological and chemical variability of common oregano (*Origanum vulgare* L. subsp. *vulgare*) occurring in eastern Poland

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Summary

Introduction: Common oregano is an important medicinal and aromatic plant, characterized by a high morphological and chemical variability.

Objective: The aim of the work was to determine the diversity of 14 common oregano populations introduced into *ex situ* conditions, in respect of morphological and developmental traits as well as content and composition of essential oil in herb.

Methods: Observations and harvest of raw material were performed in the second year of plant vegetation. Morphological and developmental characters were estimated. Total content of essential oil was determined according to European Pharmacopoeia 8th. The composition of essential oil was carried out by gas chromatography.

Results: Populations differed in respect of examined traits, i.a.: plant's height from 52.13 to 88.66 cm, number of stems per plant from 45.6 to 123.3, number of internodes per stem from 4.6 to 9.2. Fresh mass of herb was at a level of 249.0–896.6 g per plant. Total content of essential oil ranged from 0.35 to 0.87%. Sabinene, 1,8-cineole, linalool, *p*-cymene, *β*-caryophyllene and caryophyllene oxide were the dominant compounds in essential oil.

Conclusions: Number of stems and fresh mass of herb differentiated examined populations at the highest degree. Most of populations were classified as a sabinyl chemotype rich in sesquiterpenes.

Key words: ***common oregano, populations, essential oil, chemotypes, variability***

INTRODUCTION

The genus *Origanum* (*Lamiaceae* family) consist of 49 taxa belonging to 10 sections. Several species of this genus, including *Origanum vulgare* L., are rich in essential oil and commonly known as 'oregano'. *O. vulgare* is a perennial, widely distributed all over Euroasia and North Africa. Its herb is considered as one of the most traded and consumed spice [1]. It also reveals a wide range of pharmacological activities, especially antimicrobial [2-5]. Given its significant economic importance and a specific biological character, *O. vulgare* has been included into the List of Priority Species in Europe [6].

The species is extremely variable, both in its morphological traits and chemical composition [1]. According to latest taxonomy, six subspecies have been distinguished on the bases of morphological features, i.e.: *O. vulgare* L. subsp. *glandulosum* (Desfontaines) Ietswaart, *O. vulgare* L. subsp. *hirtum* (Link) Ietswaart, *O. vulgare* L. subsp. *gracile* (Koch) Ietswaart, *O. vulgare* L. subsp. *virens* (Hoffmannsegg et Link) Ietswaart, *O. vulgare* L. subsp. *vulgare* L. and *O. vulgare* L. subsp. *viride* (Boissier) Hayek [7]. It is known that subspecies differ significantly in respect of total content and composition of essential oil. This variability is strongly related to its geographical origin. It is considered that southernmost subspecies (subsp. *glandulosum*, subsp. *hirtum* and subsp. *gracile*) are rich in essential oil (more than 2%), while those from northern parts (subsp. *virens*, subsp. *vulgare*, subsp. *viride*) are medium or poor sources of volatiles [1, 8]. In general, subspecies characterized by high amount of essential oil usually accumulate carvacrol and/or thymol and their precursors (γ-terpinene and *p*-cymene), while those with low amount of essential oil are rich in other monoterpenes, e.g.: linalool, sabinene, borneol and its derivatives, often accompanied by high amounts of various sesquiterpenes [9]. It is worth noting that each *O. vulgare* subspecies create several different chemotypes defined on the basis of main compound in essential oil. This phenomenon is widely described in current literature [8-16]. However, despite of commonly accepted taxonomy, some authors treat *O. vulgare* as a collective species and do not distinguish particular subspecies [17-19]. Such data, based only on essential oil composition excluding morphological characters, can confuse understanding the complex problem of oregano variability.

O. *vulgare* subsp. *vulgare* (common oregano) is spread on the area of Central and Northern Europe and is the only representative of *O. vulgare* in Poland [16, 20]. It is a woody perennial, up to 100 cm tall. Its leaves are usually ovate and weakly pubescent with dentate margin and acute or rounded apex. Colour of petals range from white to purple. The plants are blooming from May to October [7]. They occur naturally in various type of habitats, e.g.: edges of forests, clearings, semi-dry meadows and wastelands [20]. Common oregano is important medicinal and aromatic plant. In herb there is up to 1.8% of essential oil containing predominantly sabinene, *p*-cymene, β-caryophyllene, linalool *etc.* [21-27]. According to Chalcate and Pasquier, *O. vulgare* subsp. *vulgare* is able to create nine different chemotypes [28]. This raw material is rich also in phenolic compounds, mainly phenolic acids and flavonoids. Among phenolic acids, the rosmarinic acid is present in the highest amount, followed by caffeic, vanillic, *o*-coumaric and protocatechuic acids. Flavonoids are represented here mainly by apigenine, luteoline and its derivatives [16, 26, 29]. Common oregano herb reveals various pharmacological activities, i.e. antibacterial and antifungal, diuretic, choleretic, expectorant and antioxidant [2, 3, 30]. It is used in gastrointestinal and upper respiratory tract disorders treatment, especially in veterinary. Due to a pleasant aroma, this raw material can be used as spice, as well [30].

In Poland, herb of *O. vulgare* subsp. *vulgare* is collected both from natural sites and cultivation. According to Lukas *et al.* [16], in the case of this subspecies, collection from the wild not only results in heterogeneous raw material but also can lead to genetic erosion. Data concerning wild growing common oregano populations in Europe show the impressive variability of this taxon [16, 21-23, 25]. However, such research investigated on the area of Poland are rather scarce [26, 27, 31].

The aim of the present study was to determine the differences between selected common oregano populations introduced into *ex situ* conditions, in respect of developmental and morphological traits as well as content and composition of essential oil in herb.

MATERIAL AND METHODS

Plant material

Objects of the study were 14 common oregano populations (accessions) originating from eastern

Poland (Podlaskie, Lubelskie and Podkarpackie voivodeships), introduced to *ex situ* conditions (tab. 1). In August 2011, at each natural site the vegetative cuttings were collected from 25 randomly chosen plants and used for establishing a field experiment, performed at the Experimental Field of Department of Vegetable and Medicinal Plants, WULS-SGGW, according to pattern described by Bączek *et al.* [32]. The morphological observations and harvest of raw material was done in the second year of plant vegetation (2013), at the beginning of plants blooming (June). Collected herb was dried at 35°C and subjected to chemical analysis.

Populations' seeds are kept in the National Centre for Plant Genetic Resources (Polish GeneBank), while alive plants grow in the field collection of medicinal and aromatic plants of Department of Vegetable and Medicinal Plants.

Morphological observations

Morphological and developmental characters of investigated populations were estimated according to the List of Descriptors for *O. vulgare* L. elaborated by Medicinal and Aromatic Plants Working Group of European Cooperative Programme for Plant Genetic Recourses [33]. Observations were carried out directly before harvest of raw material (June, 2013) and concerned important features differentiating species, as following: plant growth habit, plant height (cm), number of stems per plant, branching density, stem color, pubescence and degree of lignification, number of internodes per stem, foliage density, leaf length and width, shape of blade, leaf margin, shape of apex, color of petals. The beginning of flowering was evaluated (when 50% of inflorescence had flower buds). Fresh mass of herb (g × plant^{-1}) was also determined. At each population, the observations were conducted on ten plants.

Chemical analysis

Total content of essential oil was determined according to European Pharmacopoeia 8th [34]. The composition of essential oil was carried out by gas chromatography. All measurements were performed in triplicate.

The chromatographic analysis was performed using a Hewlett Packard 6890 gas chromatograph equipped with a flame ionization detector (FID) and capillary, polar column Quadrex 007 CW (25 m × 0.25 mm × 0.25 μm film thickness). The analysis was carried out using the following temperature programme: oven temperature isotherm at 60°C for 2 min., then rising from 60°C to 220°C at a rate of 4°C per min. and held isothermal at 220°C for 5 min. Injector and detector temperatures were, respectively, at 220°C and 260°C. The carrier gas (He) flow was 1.1 ml × min^{-1}. The split ratio was 1:70. Manually injection of 0.5 μl essential oil was applied. Component identification was confirmed by pure authentic samples retention times and comparison

Table 1.

Geographical localization of natural sites of investigated populations

Population no./site		Accession no	Coordinates		Province/Voivodeship
1	Drohiczyn 1	401284	N 52°24'	E 022°38'	Podlaskie
2	Drohiczyn 2	401285	N 52°23'	E 022°39'	
3	Radecznica	401286	N 50°44'	E 022°48'	Lubelskie
4	Czarnystok	401287	N 50°38'	E 022°49'	
5	Zwierzyniec	401288	N 50°37'	E 022°50'	
6	Lipowiec	401289	N 50°37'	E 022°51'	
7	Karlików	401293	N 49°26'	E 022°05'	Podkarpackie
8	Bukowsko	401294	N 49°27'	E 022°03'	
9	Łukowe	401295	N 49°26'	E 022°15'	
10	Monasterzec	401296	N 49°31'	E 022°19'	
11	Jawornik	401297	N 49°21'	E 022°05'	
12	Gruszka	401298	N 49°27'	E 022°16'	
13	Łupków	401299	N 49°14'	E 022°06'	
14	Babice	401301	N 49°48'	E 022°28'	

of linear retention indices (RI) relative to the series of *n*-hydrocarbons (C7-C30), under the same operating conditions. The percentage content of determined essential oils compounds was computed by the normalization method from the GC peak areas, without the use of correction factors.

Statistical analysis

Data were subjected to statistical analysis using Statistica® software. The coefficient of variation (*CV*) was determined.

Ethical approval: The conducted research is not related to either human or animal use.

RESULTS AND DISSCUSION

Examined common oregano populations differ both in morphological and chemical characters. It was observed that most of them were characterized by erect type of growth habit, with one exception: population no 12 represented semi-erect type (tab. 2). Plant's height varied from 52.13 to 88.66 cm, while number of stems per plant from 45.6 to 123.3. Number of internodes per stem ranged from 4.6 to 9.2. The branching density was described as intermediate (6 populations), sparce (5 populations) or dense (3 populations) (tab. 2 and 3). Results by Sivicka *et al.* [35] show similar range of plant's height (50.1–85.0 cm), however, most accessions were characterized there by semi-erect type

Table 2.

Morphological and developmental traits of investigated populations

Population no./site		Plant growth habit	Branching density	Color of stems	Stem pubescence	Degree of stem lignification	Foliage density	Shape of blade	Leaf margin	Color of petals	Beginning of flowering*
1	Drohiczyn 1	erect	intermediate	green	slighty hairy	slighty ligneous	medium	oblong	entire	pink	late
2	Drohiczyn 2	erect	dense	dark red and green	slighty hairy	ligneous	medium	ovate	denticulate	pink	late
3	Radecznica	erect	intermediate	green	slighty hairy	slighty ligneous	medium	ovate	denticulate	pink	average
4	Czarnystok	erect	sparce	green	slighty hairy	slighty ligneous	medium	oblong	dentate	pink	average
5	Zwierzyniec	erect	dense	green	slighty hairy	slighty ligneous	medium	ovate	denticulate	pink	early
6	Lipowiec	erect	sparce	green	slighty hairy	slighty ligneous	medium	rhomboid	denticulate	pink	average
7	Karlików	erect	intermediate	dark red and green	hairy	slighty ligneous	medium	oblong	denticulate	pink	average
8	Bukowsko	erect	sparce	green	slighty hairy	ligneous	dense	rhomboid	dentate	white	average
9	Łukowe	erect	intermediate	dark red and green	slighty hairy	ligneous	medium	rhomboid	denticulate	pale lilac	early
10	Monasterzec	erect	intermediate	dark red and green	slighty hairy	slighty ligneous	medium	oblong	dentate	pale lilac	early
11	Jawornik	erect	sparce	green	slighty hairy	ligneous	medium	oblong	entire	pale lilac	early
12	Gruszka	semi-erect	intermediate	dark red and green	slighty hairy	slighty ligneous	dense	rhomboid	denticulate	pink	early
13	Łupków	erect	sparce	green	hairy	slighty ligneous	dense	ovate	denticulate	pink	early
14	Babice	erect	dense	green	slighty hairy	ligneous	medium	rhomboid	dentate	pink	average

*early – the end of June, average – first decade of July, late – second decade of July of growth habit and sparce branching density. The color of stems of evaluated populations was green or dark red and green. Regarding stem pubescence, majority of populations had slightly hairy stems and only two were distinguished by hairy ones. Five of investigated populations were characterized by ligneous stems, while the others – slightly ligneous. Studied populations varied in terms of leaves and flowers characters, as well. The foliage density was medium for most populations, however the shape of blade, leaf margin and shape of apex were strongly differentiated. It is worth noting that almost all populations originated from Bieszczady (Podkarpackie Voivodeship) were characterized by rounded shape of apex, while the others – acute one. The length and width of leaves ranged from 20 to 40 mm and from 10 to 20 mm, respectively. Population No. 11 was distinguished by the highest area of leaf blade. In the most cases flower's petals were pink, three populations had pale lilac color and there was one population with white flower's petals (tab. 2 and 3). In observations of Sivicka *et al.* [35] 77% of populations was characterized by pink flower's petals, as well. In present study, populations differed also as to the earliness of blooming: these from Podlaskie Voivodeship started flowering later than the others (tab. 2). Listed traits, especially type of growth, the degree of lignification, the branching and foliar density as well as number of stems can be important from practical point of view since they impact on the yield of herb and enable its mechanical harvest. In present work, the fresh mass of herb ranged from 249.0 to 896.6 g per plant. This character differentiated examined populations at the highest degree (*CV*=0.38) and in a few cases was related to high number of stems per plant (e.g. populations no 3 and 7) (tab. 3). According to Osińska [31], fresh mass of common oregano herb varied from 784 to 1580 g per plant and depended on the population. However, Sivicka *et al.* [36] show much lower values: the average fresh mass of two-year-old plants was at the level of 127.5 g per plant. It can be suspected that such various results may be related both to genetic factors and environmental conditions, since research of Sivicka *et al.* [36] was carried out on the area of Latvia.

It was observed that the total content of essential oil in herb of examined populations varied from 0.35 to 0.87% (tab. 4). In general, such results corresponds to those obtained by other authors and confirm the thesis that *O. vulgare* subsp. *vulgare* belongs to the essential oil-poor group of oregano subspecies [1]. For instance, Lukas *et*

Table 3.

Morphological and developmental traits of investigated populations, continued

Population o./site		Plant height [cm]	Number of stems per plant	Number of internodes per stems	Length of leaf [mm]	Width of leaf [mm]	Fresh mass of herb [g × plant^{-1}]
1	Drohiczyn 1	83.06	65.7	8.1	30	15	885.0
2	Drohiczyn 2	63.53	80.3	7.8	25	15	493.3
3	Radecznica	88.66	112.0	8.3	25	15	896.6
4	Czarnystok	67.87	65.3	7.9	20	10	249.0
5	Zwierzyniec	56.13	50.0	4.6	30	17	433.0
6	Lipowiec	78.67	67.7	7.5	30	20	566.0
7	Karlików	67.73	123.3	7.2	35	15	870.0
8	Bukowsko	52.13	95.0	7.9	30	18	766.7
9	Łukowe	80.27	91.0	6.1	30	15	618.3
10	Monasterzec	66.80	95.0	7.0	35	15	576.7
11	Jawornik	66.20	45.6	5.8	40	20	263.0
12	Gruszka	55.07	55.7	7.5	25	18	423.0
13	Łupków	62.40	81.6	9.2	30	20	435.0
14	Babice	76.33	65.0	6.9	30	18	483.3
	Mean	67.82	80.57	7.12	16.73	16.73	594.46
	SD	11.09	23.36	1.22	2.81	2.81	223.28
	CV	0.16	0.29	0.17	0.17	0.17	0.38

Table 4.

The total content (%) and gas chromatographic composition (% peak area) of essential oil samples

		sabinyl type			mixed sabinyl +1,8-cineol			mixed sabinyl + acyclic		mixed sabinyl +cymyl	acyclic type	mixed acyclic + sesquiterpenes			mixed cymyl +sesquiter-penes
	RI	1	3	13	11	5	9	10	14	4	6	7	8	12	2
Total content		0.83	0.37	0.80	0.87	0.63	0.83	0.35	0.57	0.63	0.53	0.50	0.80	0.53	0.43
α-Pinene	1028	1.22	0.91	1.70	2.15	0.80	0.80	1.25	1.57	0.68	1.96	1.25	5.56	3.07	1.38
β-Pinene	1113	0.46	1.12	2.17	2.16	1.12	1,4	1.60	1.83	0.56	1.83	1.86	0.82	0.98	1.35
Sabinene	1125	25.37	25.91	14.46	19.90	17.13	12.11	14.96	15.41	21.58	6.47	8.09	1.94	7.41	6.22
β-Myrcene	1167	1.29	1.35	4.46	2.44	1.42	1.27	1.42	1.35	1.51	0.38	1.04	1.02	1.74	0.64
α-Terpinene	1181	0.40	0.3	1.45	0.47	0.92	0.60	0.92	0.00	1.67	0.00	0.15	0.40	1.57	0.14
1,8-Cineole	1205	0.85	2.22	1.45	11.94	10.03	14.66	2.33	8.34	4.48	8.87	7.91	0.19	0.44	1.57
Limonene	1209	0.70	0.94	0.37	2.08	1.44	1.47	1.00	1.87	1.15	1.12	1.22	0.23	0.74	0.70
γ-Terpinene	1247	3.25	2.50	6.06	3.65	5.58	1.76	8.25	1.48	6.45	0.15	1.37	5.74	6.19	1.60
p-Cymene	1273	1.68	2.05	7.38	2.28	4.39	1.48	2.89	5.11	10.98	8.55	8.45	5.90	4.54	12.71
α-Terpinolen	1279	0.21	0.18	0.21	0.26	0.05	0.22	0.51	0.00	0.59	0.1	0.17	0.43	0.90	0.15
Menthon	1458	0.36	0.27	2.29	0.67	2.01	1.49	1.55	1.98	0.54	0.67	4.10	4.66	2.55	3.65
Citronellal	1481	0.15	0.22	0.18	0.00	0.15	0.17	0.26	0.29	0.16	0.24	0.26	0.22	0.19	0.26
Camphor	1508	0.41	0.13	0.41	00.9	0.03	0.46	0.37	0.26	0.23	0.48	0.44	0.15	0.51	0.50
Linalool	1540	2.72	3.35	3.31	5.95	4.03	1.10	10.44	14.06	4.85	32.12	15.01	24.19	15.97	4.10
β-Caryophyllene	1593	11.45	14.80	10.75	9.70	9.79	18.18	11.78	10.09	8.33	3.54	17.76	19.56	20.12	21.28
Menthol	1633	0.05	0.37	1.46	0.42	0.11	0.49	0.56	0.64	0.15	0.28	0.64	0.09	0.22	0.71
α-Humulene	1657	2.45	0.65	3.26	1.31	1.24	1.76	1.60	0.95	1.23	0.16	0.84	1.36	0.18	0.94
α-Terpineol	1681	0.78	1.68	1.25	3.52	1.72	4.59	1.73	3.22	0.72	3.26	3.80	1.13	1.24	1.86
Germacrene D	1705	14.15	11.19	11.76	8.41	2.87	9.57	5.14	0.58	7.15	0.16	1.49	5.93	4.72	1.89
Geranial	1722	1.24	1.67	0.28	1.32	0.11	0.46	0.83	1.62	0.13	1.46	0.09	0.37	1.41	0.85
Geranyl acetate	1758	3.13	4.35	1.48	2.07	0.36	1.75	1.44	0.00	1.43	0.31	0.16	1.05	0.9	0.73
Caryophyllene oxide	1955	3.03	2.41	1.28	0.95	10.49	2.11	2.68	3.37	3.69	9.97	3.88	2.36	2.48	8.96
Nerolidol	2023	0.30	0.78	1.05	1.15	0.98	2.13	0.85	0.45	0.54	0.07	0.62	0.85	0.51	0.77
Thymol	2163	2.05	1.13	1.68	1.12	0.50	0.85	1.96	2.01	0.63	1.36	0.78	1.19	1.45	1.02
Carvacrol	2214	0.53	1.78	1.68	1.94	0.11	2.02	1.32	2.21	0.63	0.73	1.46	1.6	0.79	1.85

al. [16] provided values from 0.1 to 1.8%, while Osińska [31] indicated content from 0.3-1.3%. In the present study, 25 compounds were identified in essential oil, with a domination of sabinene, 1,8-cineole, linalool, *p*-cymene, germacrene D, *β*-caryophyllene and caryophyllene oxide (tab. 4). The high content of these substances in *O. vulgare* ssp. *vulgare* essential oil was reported earlier by other authors. According to the dominant compounds, a lot of chemotypes were distinguished, e.g *p*-cymene + *β*-caryophyllene, germacrene D + *β*-caryophyllene, sabinene, *cis*-sabinene hydrate, terpinen 4-ol, thymol *ect.* [16, 21-23, 26-28]. Although the numerous research concerning a high chemical polymorphism of common oregano were presented, many data are not clear and often not comparable with others. Some authors show chemical analysis of plant samples without any or just superficial morphological observations. It could be misleading, especially when investigations are carried out on the areas where *O. vulgare* subsp. *vulgare* coexist with other oregano subspecies [10, 15, 17-19, 24]. It seems that results shown recently by Lukas et *al.* [8, 16] may help clarify this problem. Authors claims that each *O. vulgare* subspecies can be associated with its main chemotype, what could visibly support Ietswaart's taxonomy. However, the selection of chemotypes should be related not to particular dominants but rather to the group of compounds synthesized on special metabolic pathway. In general, plants accumulating phenolic monoterpenes (thymol and carvacrol) and its biosynthetic precursors (*p*-cymen and *γ*-terpinen) belong to chemotype associated with 'cymyl' pathway, typical for essential oil-rich *O. vulgare* subspecies. In turn, plants with medium or poor oil content are characterized by less active 'cymyl' pathway in favor of the bicyclic 'sabinyl' compounds (sabinene, *cis/trans* sabinene hydrate and its acetates) or acyclic ones (i.a. linalool, linalyl acetate, *β*-myrcen, *β*-ocimene), accompanied by high amounts of sesquiterpenes (i.a. *β*-caryophyllene, caryophyllene oxide, germacrene D). It seems that the activity of mentioned biosynthetic pathways is strongly regulated by environmental conditions. In plants originating from Mediterranean climate, geranyl pyrophosphate (GPP) is usually converted by 'cymyl' or 'acyclic' pathways exhibited in domination of carvacrol in *O.vulgare* subsp. *hirtum* or linalool in *O. vulgare* subsp. *virens*, respectively. In case of *O. vulgare* subsp. *vulgare*, a plant typical for continental climate, GPP is transformed by 'sabinyl' pathway. As a result, the most common chemotype of this subspecies is a sabinyl type, rich in sesquiterpenes [8, 16]. In the present work, most of populations belong to sabinyl chemotype, pure (populations no 1, 3, 13) or mixed (populations no 4, 5, 9, 10, 11, 14) (tab. 4). In the case of populations no 10 and 14, sabinene was accompanied by a high share of linalool. This compound was also present in considerable amounts in populations no 7, 8, 12 (distinguished as mixed acyclic + sesquiterpenes types) and in population no 6 (up to 32.12%), classified as pure acyclic chemotype. High percentage of linalool in essential oil is characteristic for *O. vulgare* subsp. *virens*, occurring mainly on Iberian Peninsula [8, 11]. This compound and its derivatives appears only sporadic in *O. vulgare* subsp. *vulgare* and extremely rare in populations from Central and Northern Europe [8, 15, 16, 23]. However, the presence of linalool-rich common oregano population (up to 15.60%) on the area of Poland was reported earlier by Węglarz *et al.* [26]. Some authors point to the relationship between the essential oil profile and morphological traits of this species, e.g. color of flower's petals [21, 37]. As it was mentioned, the content and composition of essential oil in *O. vulgare* is visibly associated both with latitude and longitude [1, 8, 9]. Lukas *et al.* [8] observed an increasing west-east gradient in total essential oil yield and carvacrol/thymol amount in *O. vulgare* populations located from the Iberian to Balkan Peninsula. Results obtained in the present work do not indicate any clear relationship between essential oil composition, morphological features and geographical origin of populations. It can be suspected that the area of the research, including three Polish Voivodeships, was too small to observe such a correlation.

In general, practical application of *O. vulgare* (especially *hirtum* subspecies) essential oil results from its high antimicrobial activity, caused mainly by carvacrol/thymol domination [38]. Although *O. vulgare* subsp. *vulgare* contains small amounts of these active phenolic monoterpenes, this subspecies also indicate such activity, associated in this case with a high content of sabinene [39, 40]. However, populations rich in linalool and/or sesquirepenes (i.a. *β*-caryophyllene) can be interested from the practical point of view, as well. Due to a pleasant aroma of these substances, linalool and/or sesquirepenes-rich chemotypes of *O. vulgare* subsp. *vulgare* may be used in cosmetic industry.

To sum up, it seems that investigations on the phenomenon of extraordinary variability within *O. vulgare* species and subspecies are still up to date. Although many attempts providing to order and understand this issue, there are too many exceptions, especially in the area of chemical diversity, to take over clear rules. Thus, *Origanum* taxa can create new opportunities promising both from scientific and practice point of view.

CONCLUSIONS

1. Investigated common oregano populations evaluated in *ex situ* conditions differed in terms of morphological and developmental traits as well as content and composition of essential oil.

2. Regarding morphological features, number of stems and fresh mass of herb differentiated among examined populations at the highest degree.

3. Given essential oil composition, most of populations were classified as sabinyl chemotype rich in sesquiterpenes.

4. There was no clear correlation between geographical origin of populations and evaluated traits nor between morphological characters and chemical composition of essential oils.

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Zróżnicowanie morfologiczne i chemiczne lebiodki pospolitej *(Origanum vulgare* L. subsp. *vulgare)* występującej na terenie wschodniej Polski

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Streszczenie

Wstęp: Lebiodka pospolita jest ważną rośliną leczniczą i aromatyczną, charakteryzującą się wysoką zmiennością morfologiczną oraz chemiczną.

Cel: Celem pracy było określenie różnic pomiędzy 14 populacjami lebiodki pospolitej rosnącymi w warunkach *ex situ*, pod względem cech morfologiczno-rozwojowych, a także co do zawartości i składu chemicznego olejku eterycznego w zielu.

Metody: Obserwacje przeprowadzono w drugim roku wegetacji roślin. Ocenione zostały cechy morfologiczno-rozwojowe, oznaczono zawartość olejku eterycznego (wg Farmakopei Europejskiej 8) oraz jego skład chemiczny (metodą chromatografii gazowej).

Wyniki: Populacje różniły się pod względem analizowanych cech. Wysokość roślin wahała się od 52,13 do 88,66 cm, liczba pędów na roślinę od 45,6 do 123,3, liczba międzywęźli na pędzie od 4,6 do 9,2. Świeża masa ziela kształtowała się na poziomie 249,0–896,6 g na roślinę. Zawartość olejku wynosiła od 0,35 do 0,87%. Związkami dominującymi w olejku były: sabinen, 1,8-cineol, linalol, *p*-cymen, *β*-kariofilen i tlenek kariofilenu.

Wnioski: Cechami, które najbardziej różnicowały badane populacje była liczba pędów oraz świeża masa ziela. Większość populacji zaklasyfikowano jako chemotyp sabinylowy, bogaty w seskwiterpeny.

Słowa kluczowe: ***lebiodka pospolita, populacje, olejek eteryczny, chemotypy, zróżnicowanie***