

WHAT ARE WE CONSERVING? A CASE STUDY OF *MENTHA LONGIFOLIA* AND ALLIED SPECIES FROM LITHUANIA

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Abstract

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Assessment of the conservation status of a species, first, should be based on its clearly defined taxonomic identity. Insufficient knowledge of certain taxonomic groups may lead to misidentifications, misinterpretations and become an obstacle for conservation. *Mentha longifolia*, listed as a protected plant species of Lithuania since 1981, belongs to a taxonomically complex group of species. The aim of this research was to examine available herbarium specimens of *M. longifolia* and verify their identification, specify distribution of this species in Lithuania and evaluate its conservation status in the country. The study was based on the analysis of herbarium specimens and information provided in references and databases. We studied a total of 93 specimens initially identified as *M. longifolia*. Morphological features of 30 leaves (leaf length, leaf width, petiole length, distance from leaf base to the widest place, length of leaf tooth) of both *M. longifolia* and *M. ×villosa* were measured on herbarium specimens. After the revision of herbarium specimens, we revealed that 37.6% of specimens initially identified as *M. longifolia* belong to other species (mostly to *M. ×villosa*) and 29.0% of specimens cannot be identified precisely because of the early stage of development. Only 33.4% of *M. longifolia* specimens were identified precisely. Thus, *M. longifolia*, previously supposed as quite widespread in Lithuania, after the revision appeared to be restricted mainly to the southern and south-eastern parts of the country. Applying the IUCN criteria, *M. longifolia* was evaluated as data deficient (DD) species. Analysis of leaf morphological traits revealed that *M. longifolia* and *M. ×villosa* can be differentiated by the length and the width of leaf blade, the distance from leaf base to the widest part of leaf and by the ratio between the length and the width of middle cauline leaves. This study revealed that taxonomic revision of the genus *Mentha* in Lithuania is required. Distribution of species, ecology and state of populations, impact of alien species on native congeners should be estimated in the future.

Keywords: distribution, herbarium, hybrids, identification, Lamiaceae, leaf morphology, taxonomy.

INTRODUCTION

Taxonomy is the foundation of biodiversity science, and conservation of the biodiversity requires good expertise in taxonomy of species under concern. Many scientists consider taxonomic research to be one of the most important goals aiming to determine the biodiversity and species that need to be conserved (McNEELY, 2002; MACE, 2004; ABDELAZIZ et al., 2011; COSTELLO et al., 2015). General questions of the relationships between taxonomy and conservation

have been widely discussed by scientists and practitioners and the discussion continues (MORRISON et al., 2009; COSTELLO et al., 2015; GARNETT & CHRISTIDIS, 2017; THOMSON et al., 2018, etc.). However, insufficient knowledge about certain taxonomic groups may lead to misidentifications, misinterpretations and become an obstacle to the conservation: species that should be under protection remain outside of the view of conservationists or protection is carried out on populations of species that should not be protected. Such cases are more likely to occur with taxo-

nomically complex species or groups of species (e.g. *Hieracium* L., *Pilosella* Hill, *Taraxacum* F.H. Wigg.) (GUDŽINSKAS, 2002; GRULICH, 2012; ŠINGLIAROVÁ et al., 2013). As there are only a few specialists capable of reliable identifications of certain groups of plants, the knowledge about their distribution, vulnerability trends or threat to their populations is still largely insufficient. Therefore, even endangered but hard to identify species are frequently ascribed to the lower-risk category or recognized as data-deficient (POSSINGHAM et al., 2002; GRULICH, 2012).

Although molecular techniques have helped to solve taxonomic problems when species are difficult to separate morphologically (ABDELAZIZ et al., 2011), they cannot entirely replace traditional morphological methods of taxonomy (BEHEREGARAY & CACCONI, 2007; SCHLICK-STEINER et al., 2007). Nature conservation practitioners need to identify species in a field immediately or in a short time based on morphological features. Furthermore, the application of molecular techniques sometimes is too expensive and economically infeasible.

In 2016, the project on evaluation of protected species of Lithuania, applying the IUCN criteria, was initiated. Therefore, it was necessary to collect and analyse all available information on the state of populations and habitats of protected species in Lithuania. At the very beginning of the analysis of information, we noted significant discrepancies in the identification of *Mentha longifolia* (L.) L., and we decided to perform a revision of herbarium specimens as well as other published information on this and allied species.

The genus *Mentha* L., which includes many important medicinal and aromatic plants cultivated on an industrial scale, is among the most taxonomically complex genera of the Lamiaceae Lindl. family. This genus, depending on the taxonomic treatment, includes 18–30 species and over a dozen of hybrids (HSIWEN & HEDGE, 1994; GOBERT et al., 2002; TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009). Significant morphological variation and frequent hybridization combined with a long history of artificial selection, breeding and wide scale cultivation leading to escape and naturalization of cultivated plants further contribute to the complexity of the genus and problems of plant identification. Hybridization of *Mentha* species, variation in morphological charac-

ters and fertility of hybrids have been analysed employing classical and molecular methods (HARLEY, 1972; GOBERT et al., 2002; TUCKER & NACZI, 2007). Hybrids of certain species always are sterile, whereas other hybrids may be fully fertile (GOBERT et al., 2002; TUCKER & NACZI, 2007).

KASK et al. (1996) have described five species of *Mentha* genus distributed in the Baltic States (*M. arvensis* L., *M. ×verticillata* L., *M. ×gentilis* L., *M. aquatica* L. and *M. longifolia* (L.) L.), provided notes on four species considered as aliens and other four species doubtfully occurring in the region. KASK et al. (1996) have noted that *M. spicata* L. is frequently cultivated and occasionally recorded as escaped species, whereas report on *M. ×villosa* Huds. has been based on literature sources (SNARSKIS, 1954, 1968).

An attempt to clarify diversity of the genus *Mentha* in Lithuania has been made by ŽVINIENĖ (1998). This study is based mainly on cultivated plants that have been obtained from various sources and on lesser extent on plants collected in the nature. Unfortunately, herbarium specimens of the studied plants are not available, and verification of their identity is not possible, though it raises some doubts.

In Lithuania, the genus *Mentha* is represented by five native, four cultivated and one alien species (LEKAVIČIUS, 1976). *M. longifolia* has been included into the list of protected plant species of Lithuania since 1981 (ČIUPLYS, 2007; APLINKOS MINISTERIJA, 2007). In Estonia, *M. longifolia* is very rare species and significant part of its populations has become extinct during the last decade of the 20th century. In Latvia and Lithuania, this species is considered as quite rare (KASK et al., 1996).

The global conservation status of the *Mentha* species according to the IUCN criteria in most cases has been estimated as least concern (LC) or near threatened (NT) (RHAZI & GRILLAS, 2010; AKHANI, 2014; LANSDOWN, 2014) and only few of these have been included into the national lists of protected species. *Mentha pulegium* L. has been included into the national red lists of Belgium, Czech Republic, Luxembourg, Germany and Switzerland, and, therefore, a decline in this part of its range can be suspected (GRULICH, 2012; DE BELAIR et al., 2014). There is no information on the conservation of *M. longifolia* in other European countries, except Lithuania.

During the last two decades, much information on the distribution and localities of *M. longifolia* has been published or accumulated in databases. Preliminary review of the herbarium samples revealed significant variation in morphology of specimens and we suspected existence of certain confusion over the identification of the *Mentha* species. Therefore, the aim of this study was (a) to examine available herbarium specimens of *M. longifolia* and verify their identification, (b) to specify distribution of this species in Lithuania, (c) to evaluate morphological differences from allied species and (d) to evaluate its conservation status in the country.

MATERIALS AND METHODS

This article is based on the study of herbarium specimens of *M. longifolia* and allied species deposited at the Herbarium of the Institute of Botany of the Nature Research Centre (BILAS, Vilnius) and at the Herbarium of Life Science Centre of Vilnius University (WI, Vilnius). We studied a total of 93 herbarium specimens. Species of the genus *Mentha* were identified using identification keys published in monographic studies (HSIWEN & HEDGE, 1994; TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009) and comparing with the images of the type specimens (TUCKER et al., 1980).

Because significant part of *Mentha* specimens are misidentified, localities referred only in the literature and in the Information System on Protected Species of the Ministry of Environment of Lithuania (SRIS), but not confirmed by herbarium specimens, were not used for the analysis of distribution. Herbarium specimens of garden origin were also excluded from further analyses.

Distribution maps of *Mentha* species in Lithuania were compiled using a system of grid cells. The grid cells were arranged according to geographical co-ordinates with sides 6' latitude and 10' longitude. The area of grid cells varies from 116.5 km² in the northern to 123.2 km² in the southern part of Lithuania (GUDŽINSKAS, 1993). All localities recorded in the same grid cell on the map were marked by a single symbol. Maps of distribution were created employing *Adobe Illustrator 9.0.2 CE* software. The area of occurrence and the area of occupancy of *M. longi-*

folia in Lithuania were calculated following IUCN recommendations (IUCN, 2012a, 2017).

The length and the width of middle cauline leaves, the length of leaf-stalk and leaf-tooth of the identified *M. longifolia* and *M. ×villosa* specimens were measured. Distance from leaf base to the widest place of leaf-blade was also measured. A total of 30 leaves of each species from different specimens were measured. The ratio of leaf length and leaf width was calculated by dividing the obtained measurements of an individual leaf.

Descriptive statistical analysis of morphological characters of leaves includes mean value and standard deviation (mean ± SD) as well as minimum and maximum values. Normality of the data distribution was evaluated using the *Shapiro-Wilk* test. Statistical differences between two sets of data were determined applying the *Student's t*-test.

The list of examined herbarium specimens of *M. longifolia* was provided in Appendix I. Geographical co-ordinates, when available, were indicated according to *WGS 1984* standard.

RESULTS

Distribution and habitats

Analysis of available information on the localities of *M. longifolia* revealed that this species was quite widely distributed in Lithuania (Fig. 1). It was reported in 60 grid cells all over the country, but was almost absent in the Mid-Lithuanian Lowland. The record of *M. longifolia* in 52 map cells was confirmed by the herbarium specimens. In 17 grid cells, the specimens of *M. longifolia* were collected before 1981 and later reports about the occurrence of this species were absent. In 35 grid cells, this species was collected after 1981, but the records in eight map cells were provided only in references and not supported by the herbarium specimens.

However, revision of the herbarium specimens (93 samples) of *M. longifolia* revealed frequent misidentifications of this species. Most frequently the name *M. longifolia* was erroneously applied for specimens of the naturalized *M. ×villosa* (33.3% of specimens). Other species (*M. spicata*, *M. aquatica*, *M. ×verticillata*) were occasionally misidentified as *M. longifolia* (4.3% of specimens). Precise identifi-

cation of almost one third of herbarium specimens (29.0%) was not possible because plants had been collected in early stages of their development and the most taxonomically significant morphological features were missing. Thus, only one third of *M. longifolia* specimens (33.4%) were identified precisely. The map of *M. longifolia* distribution, based on the data of the revised herbarium specimens, revealed quite different pattern of its distribution in Lithuania (Fig. 2). So far, this species was confirmed in 19 grid cells. In nine grid cells, it was recorded before 1981 and no later records were made. In ten grid cells, this species was found after 1981, however, just in three localities (Trakai and Šalčininkai distr. and Vilnius city) *M. longifolia* was found in the 21st century. No new records of this species confirmed by the herbarium specimens were made after 2004.

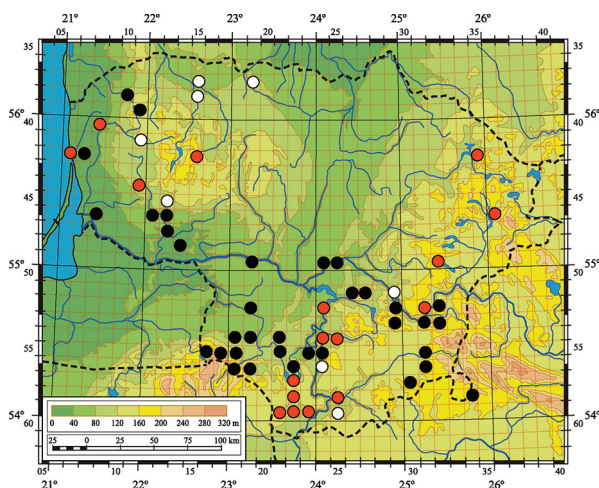


Fig. 1. Distribution of *Mentha longifolia* in Lithuania based on unrevised information of herbaria, references and databases. Localities mentioned in references and databases, but not supported by the herbarium samples, were marked by empty circles, red circles indicate localities confirmed by the herbarium samples collected before 1981 and black dots indicate localities supported by the herbarium samples collected after 1981

Most of *M. longifolia* localities were concentrated in the south-eastern part of Lithuania, mainly along the River Neris and its tributaries and in the southern part of the country (Fig. 2). A single locality of this species was registered in West Lithuania, in the environs of Kalotė village (Klaipėda distr.) in 1936. Another isolated locality of *M. longifolia* was registered in the north-eastern part of the country, in the environs of Dusetos (Zarasai distr.) in 1977.

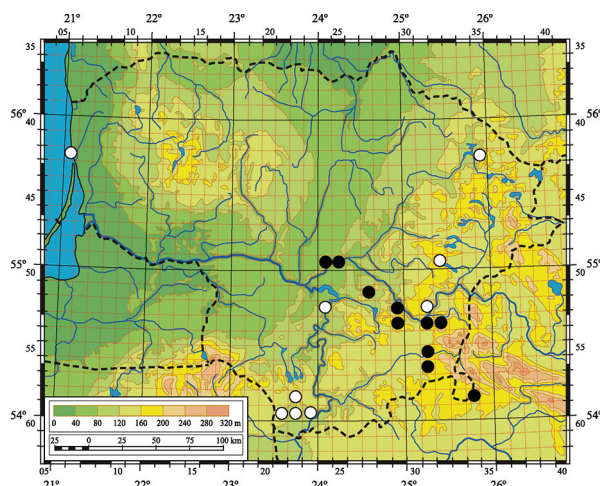


Fig. 2. Distribution of *Mentha longifolia* in Lithuania based on the revised herbarium specimens. Empty circles indicate localities registered before 1981, black dots refer to localities recorded after 1981

Judging by the data provided on the labels of the herbarium specimens, *M. longifolia* most frequently occurred along lake shores and on river banks (seven and six records, respectively). Less frequently this species was found in ditches, along edges of forests and in meadows (two records in each habitat). In five cases, *M. longifolia* occurred in anthropogenic habitats (along roads, in wastelands, along arable lands and on landfills). Thus, habitats along rivers, streams and lakes should be considered as the most important habitats for this species in Lithuania.

Assessment of *Mentha longifolia* by applying the IUCN criteria

Information about the size and the state of *M. longifolia* populations was almost absent on the labels of herbarium specimens. In several cases, the estimated size of the population was indicated. Usually thickets of *M. longifolia* occupied several square meters, occasionally they comprised about 10 m² and in one case this species occupied approximately 70 m². Thus, the actual size of *M. longifolia* population in Lithuania is unknown. Data on the density of shoots in the populations of this species are not available.

The IUCN (2012a, b, 2017) criteria for the assessment of conservation status of a species are the best tools to define the risk of species extinction at global or regional levels. The area of occurrence

(EOO) of *M. longifolia* in Lithuania, calculated based on localities confirmed by the herbarium specimens, was 40 467 km² (62% of the territory of Lithuania), whereas the area of its occupancy (AOO) covered 105 km². This species was recorded in 22 localities; however, in only less than half of these, in ten localities, *M. longifolia* has been recorded during the last two decades (Fig. 2). Although a decrease in the number of populations and deterioration of the quality and extent of suitable habitats is expected, because of the lack of actual information, *M. longifolia* should be evaluated as data deficient (DD) species.

If the area of occurrence of *M. longifolia* was calculated using primary data (unrevised herbarium specimens, reference and database information, which include a significant part of *M. ×villosa* localities; Fig. 1) on the distribution of this species, then it would be 47 139 km² (72% of the territory of Lithuania) and the area of occupancy would cover 374 km². In this case, considering the reported numerous anthropogenic habitats and the number of localities, *M. longifolia* would be evaluated as species of least concern (LC) and, therefore, for a certain time excluded from further considerations about the necessity of its conservation.

Morphological features

Revision of herbarium samples revealed that *M. longifolia* was most frequently mistaken with *M. ×villosa* and *M. spicata*. However, because of small number of available *M. spicata* specimens, we were unable to make reliable comparison among the three species.

Mentha longifolia and *M. ×villosa* may be reliably identified using characteristics of middle cauline leaves. These species well differed by the leaf length, the leaf width, and the length of leaf tooth (Table 1). The length of petiole did not differ between the studied species. Leaves in the middle of the stem of *M. longifolia* were reliably ($t(29) = 7.09$; $p < 0.001$) longer (mean 77.30 ± 13.93 mm) and reliably ($t(29) = -8.50$; $p < 0.001$) narrower (mean 21.13 ± 4.34) than leaves of *M. ×villosa* (mean length was 54.57 ± 10.69 mm; mean width was 31.03 ± 4.67 mm).

Although the mean length and width of the leaf statistically significantly differed between *M. longifolia* and *M. ×villosa*, the measurements of individual

Table 1. Comparison of *Mentha longifolia* and *M. ×villosa* leaf features based on the studied herbarium specimens (mean \pm SD; numbers in brackets indicate the range of variation). Non-significant t -test differences ($p > 0.05$) between the same characters of the studied species are marked with *ns*

Feature	<i>Mentha longifolia</i>	<i>Mentha ×villosa</i>
Leaf length (mm)	77.30 ± 13.93 (51–105)	54.57 ± 10.69 (33–82)
Leaf width (mm)	21.13 ± 4.34 (12–31)	31.03 ± 4.67 (22–42)
Petiole length (mm)	1.37 ± 0.45^{ns} (1–2)	1.62 ± 0.49^{ns} (1–3)
Leaf tooth length (mm)	1.90 ± 0.40 (1–2.5)	1.50 ± 0.44 (1–2.5)
Distance between the base and the widest part of leaf (mm)	42.57 ± 8.17 (28–58)	17.37 ± 5.20 (10–32)
Leaf length and width ratio	3.70 ± 0.49 (2.8–5.1)	1.76 ± 0.24 (1.2–2.2)

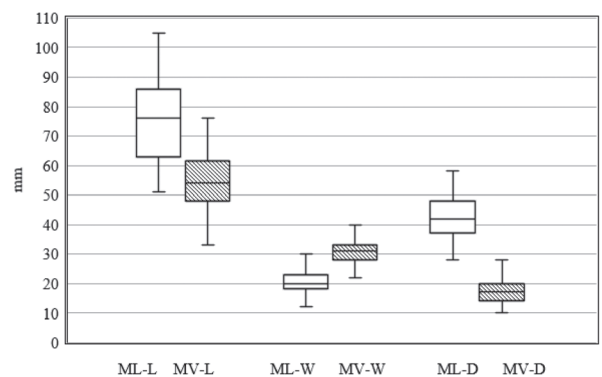


Fig. 3. Comparison of leaf length (L), leaf width (W) and distance (D) between the base and the widest part of *Mentha longifolia* (ML; empty boxes) and *M. ×villosa* (MV; shaded boxes) leaves. Whiskers indicate standard deviation.

leaves may overlap. Therefore, the best character to distinguish these species is a ratio of leaf length and width (Table 1). The ratio of *M. longifolia* leaf length and width was close to four (mean 3.70 ± 0.49 , range from 2.8 to 5.1), whereas the ratio of *M. ×villosa* leaf length and width was close to two (mean 1.76 ± 0.24 , range from 1.2 to 2.2). Distance between the base and the widest part of leaf was statistically reliable ($t(29) = 14.25$; $p < 0.001$) and easily appreciable feature (Fig. 3). The widest part of *M. longifolia* leaf was close to the middle of leaf blade, whereas the widest part of *M. ×villosa* leaf was close to the base of leaf blade.

DISCUSSION

Distribution and habitats

Verification of a part of the published reports on the records of *M. longifolia* (BALVOČIŪTĖ, 1994; GUDAVIČIUS, 1994; JANKAUSKIENĖ & LAPELĖ, 1994; KULBIS, 1994; JANKAUSKIENĖ, 1996; KRIAUCIŪNIENĖ, 1997; OBELEVIČIUS, 1998, 2000; KYBRANCIENĖ & ZARANKAITĖ, 2000, etc.) is not possible because of the absence of herbarium specimens. However, judging by the provided information on the habitats and the state of populations we can suppose that at least part of the published information is based on misidentified specimens. Some confusion for the researchers could have caused a photograph published in the *Red Data Book of Lithuania* (ČIUPLYS, 2007) as *M. longifolia*, though in fact it represents *M. ×villosa*. It should be noted that most of the localities reported by RINKEVIČIUS (1997a, b, 1998, 2000) have been confirmed by precisely identified specimens of *M. longifolia*, though reports of other researchers, who provided herbarium specimens (BALSEVIČIUS, 1994; LAZDAUSKAITĖ & PATALAUSKAITĖ, 1995; BALSEVIČIUS & KATILIUS, 1998), have been based mainly on misidentified specimens.

Distribution of *M. longifolia* in Lithuania is uneven and most of localities are related to rivers and lakes in the southern and south-eastern parts of the country with few isolated localities in other regions. Although ČIUPLYS (2007) has reported that this species is concentrated in the south-western part of Lithuania, most of the localities have been indicated based on misidentified specimens. BALSEVIČIUS & NARIJAUSKAS (2016) have also indicated many localities of *M. longifolia* in Alytus, Lazdijai, Marijampolė and Vilkauskis districts (south-western Lithuania), however, their reports have been based mainly on the same information used earlier by ČIUPLYS (2007).

Analysis of the specimens re-identified by us as *M. ×villosa* revealed that in most cases they had been collected in anthropogenic habitats (in wastelands, along roads, in ditches, on field edges, etc.), though a part of these had been collected in natural and semi-natural habitats on river banks, lake shores, in wet meadows, etc. Thus, both species occupy same or similar habitats and alien *M. ×villosa* is a potential competitor of the native *M. longifolia*.

Identification of *Mentha longifolia* and *Mentha ×villosa*

Mentha longifolia may be distinguished from similar species by quite narrow, lanceolate leaves with cuneate base and very short leaf stalk. Constant and reliable feature of *M. longifolia* is the ratio of leaf length and its width, which is usually close to four (ranges from 2.8 to 5.1). The widest place of leaf blade is close to its middle. Leaf margin of *M. longifolia* is coarsely dentate, with sharp tooth, which usually are almost perpendicular to leaf margin (Fig. 4, A). Furthermore, anthers of *M. longifolia* are smaller (0.2–0.4 mm) than anthers of allied species (TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009).

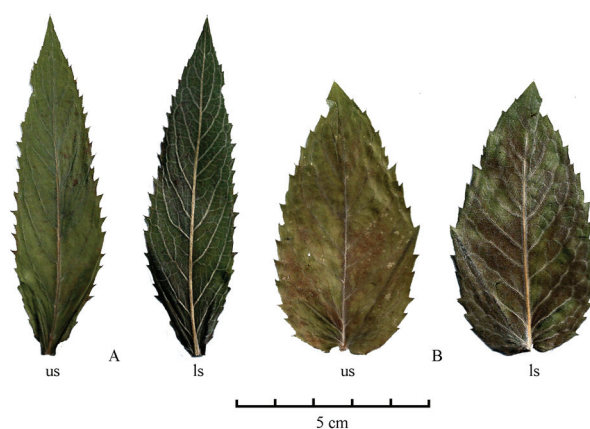


Fig. 4. Middle cauline leaves of *Mentha longifolia* (A) and *M. ×villosa* (B): us – upper surface, ls – lower surface

Leaves of *M. ×villosa* are of various shape, however, they usually are ovate or broadly ovate, occasionally suborbicular, with cordate or subcordate base and short leaf stalk. The widest leaf blade part is at the base or well below the middle. The ratio of length and width of leaf is close to two (ranges from 1.2 to 2.2). Leaf margin is almost evenly serrated with tooth clearly pointed towards the apex of leaf blade (Fig. 2, B). Anthers of *M. ×villosa* are usually at least 0.5 mm or longer (TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009).

Mentha ×villosa is a hybrid, therefore, it is sterile (GOBERT et al., 2002), whereas *M. longifolia* is a fertile (TUCKER & NACZI, 2007) species and its fertility may be easily established soon after the anthesis by developing nutlets.

Analysis of the herbarium material revealed that significant part of specimens cannot be identified, be-

cause plants had been collected during early stages of plant development. Specimens of *M. longifolia* and allied species collected in June or early July usually have almost orbicular lower leaves and such plants cannot be precisely identified. Accurate identification of the species is possible only by flowering individuals, which are collected at full anthesis or at later stages of flowering, when features of anthers and fertility of plants may be estimated. Leaf shape should be estimated, and the measurements should be taken from the middle cauline leaves, because lower cauline leaves, leaves on branches and leaves in the inflorescence usually have different size, shape and often uncharacteristic indumentum. Therefore, the best time to collect *Mentha* species in Lithuania is in August and September. It should be noted that injured and regrown individuals also develop uncharacteristic leaves and precise recognition of such specimens is also quite complicated. Properly collected herbarium sample should consist of at least two thirds of the upper part of the flowering shoot.

Threats and conservation

Information collected during the last two decades about localities of *M. longifolia* and frequently based on misidentified specimens caused false impression of its increasing frequency in Lithuania. However, in fact these data have hid the true state of the species and necessity of its thorough studies (POSSINGHAM et al., 2002). This fact highlights the need for studies on taxonomically complex genera, and particularly when we are dealing with protected species. Unbiased evaluation of the conservation status and reduction of extinction probability of certain species are possible only based on thorough taxonomic studies combined with investigations on its distribution, population ecology and biology.

This case study is an example of possible changes in the conservation status of a species depending on taxonomic studies. *M. longifolia*, which had been supposed to be increasing in frequency and, therefore, ascribable to the category of least concern (LC) species, in fact appeared quite rare and current state of its populations is almost unknown. Therefore, *M. longifolia* is evaluated as data deficient (DD) and further studies may reveal even higher threat to its populations and different assessment of its conservation status.

Mentha longifolia is listed as protected species threatened by the usage of herbicides, ploughing, drainage of habitats and overgrowth of meadows by trees and shrubs and expansion of escaped populations (ČIUPLYS, 2007). In our opinion, the populations of *M. longifolia* in Lithuania are mainly threatened by changes in riparian habitats because of alien species (e.g. *Acer negundo* L., *Echinocystis lobata* (Michx.) Torr. et A. Gray, *Impatiens glandulifera* Royle, *Solidago gigantea* Aiton) invasion (GUDŽINSKAS & ŽALNERAVIČIUS, 2017).

Analysing optimisation of the conservation of plant species in strict nature reserves of Lithuania under the climate change, IGNATAVIČIUS & TOLEIKIENĖ (2017) have concluded that *M. longifolia* has the best perspectives among all protected species. However, our study revealed that in fact *M. longifolia* has never been recorded in the analysed strict nature reserves. Therefore, the conclusion about the highest positive reaction of *M. longifolia* to the climate change is not substantiated and probably based on the evaluation of other species of the genus *Mentha*. According to our results, further studies on the state of *M. longifolia* are required, and in the future this species could be categorized in one of the IUCN threat categories (IUCN, 2012b, 2017).

Although ČIUPLYS (2007) has indicated that at least part of *M. longifolia* populations represent escaped plants, our study does not support this opinion. *M. longifolia* is a rare plant in cultivation, whereas other species and hybrids prevail in gardens. Almost all populations that are supposed to be represented by escaped plants in fact belong to naturalized and fast spreading *M. ×villosa*. At least some, if not all, populations of *M. longifolia* occurring in anthropogenic habitats (along roads, in ditches, etc.) may be relics of former native populations growing in drained wet meadows, streams or other habitats.

The impact of *M. ×villosa* on the stability of *M. longifolia* population is unknown and should be investigated, however, interspecific competition between species occupying similar habitats may be suspected. Attention should also be paid to the study of threats rising from the hybridization of *M. longifolia* with the native and alien congeners (TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009). Hybridization has the potential to impact not only the hybridizing species, but also other components of a community

(ELLSTRAND & SCHIERENBECK, 2000). A striking example is the invasion of hybrid *Spartina* Schreb. in estuaries, where vigorous recombinant genotypes alter patterns of sedimentation and water flow, with many cascading effects on native plants and animals (NEIRA et al., 2005).

This study revealed that the diversity of the genus *Mentha* in Lithuania is insufficiently known, and existing treatments of the species (LEKAVIČIUS, 1976; KASK et al., 1996) have not been justified with the type specimens (TUCKER et al., 1980) and currently accepted concepts of *Mentha* species (TUCKER & NACZI, 2007; ŠARIĆ-KUNDALIĆ et al., 2009, etc.). Therefore, taxonomic revision of the genus *Mentha* in Lithuania is required aiming to reveal its actual diversity. Distribution of species, ecology and state of populations as well as the impact of alien species on native congeners should be investigated.

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KĄ MES SAUGOME? MIŠKINĖS MĖTOS (*MENTHA LONGIFOLIA*) IR ARTIMŲ RŪŠIŲ ATVEJO ANALIZĖ LIETUVOJE

Lukas PETRULAITIS, Zigmantas GUDŽINSKAS

Santrauka

Siekiant nustatyti tam tikros rūšies apsaugos statusą, pirmiausia būtina tiksliai nustatyti jos taksonominę priklausomybę. Stingant žinių apie kai kurių rūšių, ypač apie taksonomijos požiūriu sudėtingų augalų grupių atstovus, gali būti ne tik klaidingai nustatoma rūšies tapatybė, bet ir priimami klaidingi vertinimai dėl tos rūšies augalų apsaugos poreikio.

Miškinė mėta (*Mentha longifolia*), kuri į Lietuvos saugomų augalų sąrašą įrašyta nuo 1981 m., yra vienas iš taksonomijos požiūriu sudėtingos mėtos (*Mentha* L.) genties atstovų. Šio tyrimo tikslas buvo patikrinti ir kritiškai įvertinti Lietuvos herbariumuose saugomus *M. longifolia* pavyzdžius, patikslinti rūšies paplitimą ir apsaugos statusą šalyje. Buvo išnagrinėti 93 herbariumo pavyzdžiai, kurie anksčiau buvo apibūdinti kaip *M. longifolia*, įvertinta literatūros šaltiniuose skelbta ir duomenų bazėse saugoma informacija. Siekiant įvertinti *M. longifolia* ir dažnai su ja

painiojamos *M. ×villosa* morfologinius požymius, išmatuota po 30 kiekvienos rūšies herbariumuose saugomų augalų lapų. Matuotas lapo ilgis, lapo plotis, lapkočio ilgis, atstumas nuo lapo pamato iki plačiausios lapalakščio vietos ir lapo dantelio ilgis.

Atlikus herbariumo pavyzdžių reviziją nustatyta, kad 37.6% pavyzdžių, anksčiau apibūdintų kaip *M. longifolia*, iš tikrųjų priklauso kitoms rūšims (daugiausia – *M. ×villosa*). Dar 29.0% pavyzdžių tiksliai apibūdinti neįmanoma, nes augalai surinkti per anksti – neturi žiedynų ir visiškai išaugusių stiebo vidurinės dalies lapų. Tik 33.4% *M. longifolia* pavyzdžių buvo apibūdinti teisingai. Nustatyta, kad *M. longifolia* nuo *M. ×villosa* galima patikimai atskirti pagal visiškai išaugusių vidurinės stiebo dalies lapo ilgį, lapo plotį, atstumą nuo lapo pamato iki plačiausios lapalakščio vietos. Patikimas ir lengvai įvertinamas požymis – lapo ilgio ir pločio santykis.

Mentha genties augalai, siekiant juos tiksliai apibūdinti, turėtų būti renkami žydėjimo laikotarpiu, geriausia – antroje žydėjimo pusėje, kai galima įvertinti ir vaisių mezgimą.

Anksčiau buvo manoma, kad *M. longifolia* Lietuvoje yra gana plačiai paplitusi rūšis, tačiau šių tyrimų rezultatai parodė, kad ji paplitusi tik pietinėje ir pietrytinėje, o vakarinėje ir šiaurės rytinėje šalies da-

lyse buvo rasta tik prieš daugiau kaip pusę amžiaus. Straipsnyje aptariamas *M. longifolia* apsaugos statusas Lietuvoje. Remiantis šio tyrimo rezultatais galima teigti, kad būtina atlikti visos *Mentha* genties reviziją šalyje, o jos pagrindu ateityje turėtų būti įvertintas rūšių paplitimas, jų populiacijų būklė ir ekologija. Taip pat svarbu įvertinti svetimžemių *Mentha* genties rūšių įtaką vietinėms tos pačios genties rūšims.

APPENDIX I.

List of the studied herbarium specimens of *Mentha longifolia* (L.) L. The list was arranged chronologically. Herbarium code and specimen identifier were added at the end of the translated label in parentheses. In case of changes in administrative division or geographical name, formerly used administrative units or locality names were provided in square brackets.

1. Vilnius, environs of Žalieji Ežerai [Zielone Jeziora], bank of a river; 19 July 1921, leg. W. Sławiński (WI P30277).
2. Lazdijai distr., Pateriai village, in a shrubbery along Lake Snaigynas; 6 August 1930, leg. G. Zimanas (WI P30280).
3. Druskininkai city, on the bank of Lake Druskonis; 29 July 1934, leg. Z. Gołębówna (WI P30278).
4. Klaipėda distr., Kalotė, in a rivulet, on the right side of the River Dangė, upstream the bridge; 17 September 1936, leg. P. Snarskis (WI P30281).
5. Molėtai distr. [Ukmergė region], Dubingiai, at the road; 29 July 1947, leg. M. Natkevičaitė (BILAS 11112).
6. Molėtai distr. [Ukmergė region], Dubingiai; 29 July 1947, leg. J. Dagys (WI P30497).
7. Lazdijai distr., on the bank of Lake Veisiejis; 23 August 1956, leg. I. Šarkinienė (WI P22774).
8. Lazdijai distr., Veisiejai, on the southern bank of Lake Ančia; 23 August 1957, leg. I. Šarkinienė (WI P22773).
9. Kaišiadorys distr., Kruonis–Darsūniškis, in the valley of the River Nemunas, on the bank of a small rivulet, at the foot of a hill; 12 September 1958, leg. P. Snarskis (BILAS 11108).
10. Kaunas distr., environs of Drąseikiai, Lepšiškiai village; July 1965, leg. E. Masaitis (BILAS 92596).
11. Lazdijai distr., environs of Veisiejai, west bank of Lake Vilkas, in a wetland; 21 July 1971, leg. A. Lekavičius (BILAS 11102).
12. Zarasai distr., Dusetos, on the bank of Lake Sartai; 1 August 1977, leg. V. Rinkevičius (BILAS 53317).
13. Vilnius city, bank of the River Vilnelė, at Belmontas Str., in a shrubbery, quite abundant; 1 September 1991, leg. Z. Gudžinskas (BILAS 70638).
14. Šalčininkai distr., 2.5 km west of Šalčininkai, on landfill, not abundant; 18 August 1992, leg. Z. Gudžinskas (BILAS 70640).
15. Šalčininkai distr., 2 km southwards from Jašiūnai, Gojus village, in a wet ditch on the roadside, about 5 m² stand; 16 July 1995, leg. V. Rinkevičius (BILAS 92598).
16. Vilnius city, Paupys, on the bank of the River Vilnelė, about 10 m² stand; 2 August 1997, leg. V. Rinkevičius (BILAS 92599).
17. Vilnius city, Markučiai, on the bank of the River Vilnelė, close to the stadium, about 30 individuals. 24 July 1998, leg. V. Rinkevičius (BILAS 92600).
18. Jonava distr., 7 km west of Jonava, Skrebinai village, in the valley of the River Neris, on the bank of the river, in nitrophilous tall-herb community, quite abundant; 28 June 1999, leg. A. Balsevičius (BILAS 87553).
19. Jonava city, Skaruliai, on the slope of the River Neris, 300 m southwest of the bridge, at Kaunas–Zarasai road, abundant; 17 July 1999, leg. V. Rinkevičius (BILAS 92603).

20. Kaišiadorys distr., 3.5 km west of Žasliai, Geri Vakarai village, on the slope of railway embankment, quite abundant, in 70 m² area; 19 July 1999, leg. V. Rinkevičius (BILAS 92601).
21. Šalčininkai distr., Verseka village, the Gauja Landscape Reserve, Dieveniškės Historical Regional Park, in a wet shrubbery along the River Verseka; 1 August 2000, 54.179782° N, 25.681311° E, leg. Z. Gudžinskas (BILAS 92597).
22. Trakai distr., 8 km east of Vievis, bank of the River Bražuolė, Neris Regional Park, under the bridge, in a meadow along shrubs, small stand; 2 August 2000, 54.756200° N, 24.958500° E, leg. Z. Gudžinskas (BILAS 70379).
23. Vilnius city, Markučiai, left bank of the River Vilnelė, on a wet floodplain meadow at shrubbery; 28 August 2003, leg. J. Tupčiauskaitė (WI P30285).
24. Trakai distr., Sibirka village, on the edge of arable field, close to remains of a former homestead, about 10 m² stand; 25 August 2004, leg. M. Ryla (BILAS 92602).