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NEW KNOWLEDGE ABOUT SPECIES OF THE GENUS *CHAEROPHYLLUM* (APIACEAE) IN LATVIA

Pēteris Evarts-Bunders*, Gunta Evarte-Bundere

Daugavpils University, Institute of Life Sciences and Technology, Parādes Str. 1A, Daugavpils LV-5401, Latvia
*Corresponding author. E-mail: peteris.evarts@biology.lv

Abstract

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The genus *Chaerophyllum* belongs to the Apiaceae family, which is one of the most complicated and difficult to identify in Latvia. There are five species verified by herbarium materials known in Latvia: *Chaerophyllum aromaticum* – native species, rather frequent in all regions in forests, parks and shrublands, *C. aureum* – anthropophyte, known only from one locality in Daugavpils city along the railway, *C. bulbosum* – anthropophyte, earlier grown as a root vegetable and now found rarely in parks, at roadsides, waste places, along fences and under canopy of trees close to human settlements, *C. hirsutum* – native species, known from several localities only in south-eastern part of Latvia, mostly in the Daugava valley – forested ravines, slopes of broad-leaved forests, and *C. temulum* – alien species, known only from few localities – waste places, railway sides and old manor parks in the whole territory of Latvia. The most striking results are related to the distribution of *C. hirsutum* in Latvia. The literature sources and herbarium material of *Anthriscus nitida*, previously known and collected in Latvia, after our critical revision are considered as *Chaerophyllum hirsutum*, whereas *Anthriscus nitida* at least in the Latvian flora has not been identified yet and has been removed from the flora lists by mistake.

Keywords: alien species, Apiaceae, distribution, flora, Latvia, rare species.

INTRODUCTION

Chaerophyllum L. is a genus of the Apiaceae family, includes about 46 Paleotropical species. It is native to Europe, Asia, North America and northern Africa. The highest diversity of the genus *Chaerophyllum* is observed in Europe, where at least 34 species are found mostly in Asia Media and Mediterranean region (Cannon, 1968; Hand, 2011; Hassler, 2018) and only two species occur in North America (Spalik & Downie, 2001) and two in China (Menglan & Watson, 2005).

The genus *Chaerophyllum* is represented in Latvia by three species with different floristic status – *Chaerophyllum aromaticum*, *C. temulum*, *C. bulbosum* (Fischer, 1791; Fleischer 1839; Pētersone, 1957). According to the latest list of vascular plant taxa of Latvia (Gavrilova & Šulcs, 1999) as well as flora of the Baltic countries (Jankevičiene et al., 1996), there are no changes in the number of *Chaerophyllum* species in the studied region.

Another taxon – *C. hirsutum* is known in Latvia only according to old literature data (Fiedorowicz, 1851; Lehmann, 1895; Jankevičiene et al., 1996). In the latest studies, another species, *C. aureum*, has been found as alien species in Daugavpils (Priedītis, 2014; Evarts-Bunders & Evarte-Bundere, 2015; Baroniņa, 2015).

The diversity of *Chaerophyllum* species in the countries adjacent to Latvia is quite similar. Three

species of the genus *Chaerophyllum* have been recorded in Estonia: the native *C. aromaticum* and *C. temulum* and alien *C. bulbosusm* (Talts, 1969; Kuusk & Kukk, 1998; Kukk, 1999; Kukk & Kull, 2005). In Lithuania, this genus is represented by three native species: *C. aromaticum*, *C. hirsutum* and *C. temulum* and one anthropophyte *C. bulbosum* (Snarskis, 1954; Jankevičiene, 1976; Gudžinskas, 1999). Five *Chaerophyllum* species are encountered in Poland: *C. aromaticum*, *C. aureum*, *C. bulbosum*, *C. hirsutum* and *C. temulum* (Mirek et al., 2002). In Belarus, four species of *Chaerophyllum* have been reported: *C. aromatcium*, *C. bulbosum*, *C. temulum*, *C. cicutaria* Vill. (synonym of *C. hirsutum*) and *C. prescotii* DC. as potentially possible (Schischkin, 1955; Parfenov, 1999). In the north-west region of Russia (Pskov and St. Petersburg provinces) (Pimenov & Ostroumova, 2012), the same five species as those mentioned in Belarus (Tzvelev, 2000) have been recorded. In Scandinavian region, five European species are mentioned: *C. aromaticum*, *C. aureum*, *C. bulbosum*, *C. prescotii* and *C. temulum*. Other two rare casual species are known only from one or few localities in Scandinavia – *C. hirsutum* and North American *C. tainturieri* Hook. & Arn. (Fröberg, 2010).

The preliminary study on herbaria specimens showed that nearly all previously collected *C. hirsutum* and *C. aureum* herbaria had been identified incorrectly and are often confused with other *Chaerophyllum* species or even similar *Anthriscus nitida*, thus complicating the situation with the composition of the genus species and their distribution. Another 'weak spot' is the lack of new herbaria and topical field research in Latvia. The researches into the plant distribution show that only the localities that have been inspected and where the plant has been encountered for the last 20–25 years should be considered as actual for perennial plants (Jurševska & Evarts-Bunders, 2010; Evarts-Bunders et al., 2016), therefore, the present distribution of the species can be discussed solely according to the localities and dates back to not earlier than the beginning of 1991.

The aim of the study was to evaluate all available data on *Chaerophyllum* in Latvia, study the distribution patterns, compare the main morphological differences and clarify the floristic status of all *Chaerophyllum* taxa.

MATERIALS AND METHODS

All specimens of *Chaerophyllum* herbaria (except for *C. aromaticum* – well known and widely distributed species with non-problematic floristic status, therefore, in the Result section there is no analysis of the species' morphological features and distribution), deposited at the Institute of Life Sciences and Technology, Laboratory of Botany, Daugavpils University (DAU), containing 64 herbarium specimens, and Laboratory of Botany, Institute of Biology, University of Latvia (LATV), containing 68 herbarium specimens, were revised in 2014–2017. A comprehensive revision of most known localities of *Chaerophyllum* species was performed in various regions of Latvia during the vegetation season in 2007–2017 (especially – localities of *C. aureum*, *C. hirsutum* and *C. temulum*), and the analysis of literature, with special attention to distribution and floristic status of rare, unclear *Chaerophyllum* species in Latvia, was carried out.

The authors of taxa were mentioned in accordance with a list of authors of plant names (Brummit & Powell, 1992). The list of *Chaerophyllum* species in the text was arranged in the alphabetical order.

The comparison of diagnostic characters for all *Chaerophyllum* species was based on herbarium specimens collected in Latvia as well as on different relevant taxonomic literature (Tutin, 1980; Bojnanský & Fargašová, 2007; Fröberg, 2010; Pimenow & Ostroumova, 2012). The status of *Chaerophyllum* species whether the taxon is native or alien to Latvia was determined. In this study, we used widely accepted term *alien plant*, clearly defined along very similar lines by different authors (Richardson et al., 2000; Pyšek et al, 2004; Stace & Crawley, 2015).

Species distribution maps were prepared by applying the square method, which is related to the geographical coordinates, where one square corresponds approximately to 7.6 × 9.3 km (Tabaka et al., 1980). Maps were made in order to enable the analysis of the age of localities, the dynamics of species distribution across the country. Since the data on *Chaerophyllum* species distribution had not been complete until 1940s, in that case the species occurrence was shown not in three, but only in two stages:

1. The period until 1990 (all available old data until World War II and the years of Soviet occupation, when Latvia experienced significant changes in

land processing methods and transport flow, mainly the flow of railway transport from the East).

2. The period of second independence from 1991 – until nowadays, when land processing methods and directions of transport flow changed significantly again.

All our collected and cited herbarium specimens were deposited at the Herbarium of Daugavpils University, Institute of Life Sciences and Technology (DAU) and registered in the database of the Herbarium Universitatis Daugavpilensis (db.biology.lv).

RESULTS

Chaerophyllum aureum L.

Robust perennial plant, alien taxon known only from one locality in Latvia and Baltic countries in general, in Daugavpils city near Grīva Railway Station along the railway (Fig. 1), as dominant in ruderal places and grasslands. The species was found by N. Priedītis in 1996 (herbaria material, unfortunately, not collected), but identified incorrectly as *C. hirsutum* (Priedītis, 2014). First known herbarium material was collected at the same place and re-identified as *C. aureum* only in 2007 (DAU 59062002, DAU 59062003, DAU 59062004, DAU 59062005, leg. U. Suško 2007. 08. 06. det. P. Evarts-Bunders). Two duplicates of DAU herbaria are also stored in LATV herbarium. The re-inventory of the locality by P. Evarts-Bunders and G. Evarte-Bundere in 2009, 2014 and 2016 showed that the species was actively expanding, successfully competing with native species and forming a pure stand in the area of 1 ha, thus showing signs of invasiveness.

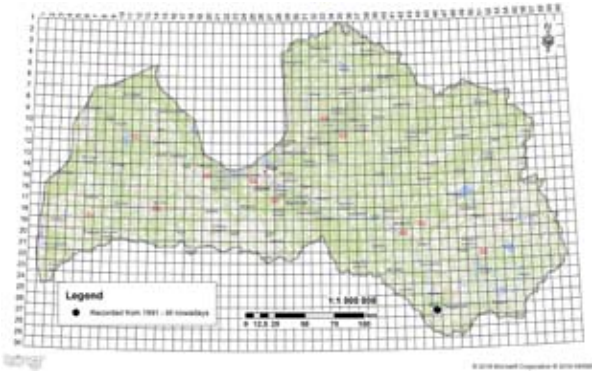

Fig.1. Distribution of *Chaerophyllum aureum* L. in Latvia

Chaerophyllum bulbosum L.

Robust biennial or perennial alien plant, earlier grown as a root vegetable and now found as anthropophyte in abandoned gardens, old manor parks, in ruderal places and along roadsides, mainly in the central and western parts of Latvia (Fig. 2). Despite the fact that the species had been known for a long time, the first herbaria in Latvia were collected in 1896. The species produce fertile seeds and occasionally actively spread to the wild, the total amount of localities in the country is not big and it tends to decrease (Fig. 3).

Fig. 2. *Chaerophyllum bulbosum* L. in Remte Manor Park. Photo: P. Evarts-Bunders

Table 1. Summary of diagnostic characters for the species of *Chaerophyllum* in Latvia

Plant part		*Chaerophyllum aromaticum*	*Chaerophyllum aureum*	*Chaerophyllum bulbosum*	*Chaerophyllum hirsutum*	*Chaerophyllum temulum*
Stem	Height Structure	90–150 cm Stem solid, usually distinctly swollen below the nodes.	50–150 cm Stem hollow, more or less swollen below the nodes.	150–250 cm Stem hollow, swollen below the nodes	50–100 cm Stem hollow, swollen below the nodes	30–100 cm Stem solid, swollen below the nodes
	Colour	With purplish patches or greenish	Purple spotted stem	With purplish patches or sometimes entirely purplish, with sparse indumentum	Dull green, usually without purplish spots	Purple-spotted or entirely purple
	Hairiness	Sparsely hairy or glabrous	Hairy	Sparsely hairy upper internodes usually glabrous	Hairy	Scattered, deflexed hairs, and usually also sparsely bristly
Leaf	Blade	1–3 pinnated	Tripinnated	Tripinnated	Tripinnated	2– to 3–pinnate
	Colour	Gray-green	Yellowish green	Bluish green	Slightly lustrous green	Dark green
	Hairiness	Densely pubescent beneath, sparsely above	Appressed hairy on both surfaces, long-petiolate	Bristly, upper – sessile and glabrous	With long hairs, upper glabrous	Appressed – hairy on both surfaces
	Lobes	Serrate to doubly serrate, teeth acuminate, usually with purplish tip	Deeply toothed or lobed, the teeth gradually narrowed at the apex	Narrowly long pinnated	Deeply toothed, teeth gradually narrowed at the apex	Deeply toothed, the teeth abruptly contracted at the apex
Umbel		With 13–28 glabrous rays, 2.8–4.1 cm long, peduncle shorter than the rays	With 15–25 nearly glabrous rays, 1.5–3 cm long, peduncle usually longer than the rays	With 11–20 glabrous rays, 2–4.5 cm long, peduncle shorter than the rays	With 10–20 glabrous rays, 4–8 cm long, peduncle considerably shorter than the rays	With 6–14 hairy rays usually 1.5–5 cm long; peduncle longer than the rays, hairy
Bracts Bracteoles		Absent or rarely 1–3 bracteoles 7–9 persistent, border ciliate and distinctly membranous	Absent or rarely 1–3 bracteoles 5–8, about as long as the pedicels in flower, hairy	Absent or rarely 1–2 bracteoles 3–4, usually persistent, about as long as the pedicels in flower, glabrous, with membranous border	Absent or rarely 1–2 bracteoles 5–6, usually persistent, about as long as the pedicels in flower, glabrous, with membranous border	Absent or rarely 1 or 2 bracteoles 5–8, shorter than the pedicels, ciliate, eventually deflexed
Flower	Colour Styles	White Directed outwards to slightly deflexed	Pure white Directed outwards to slightly deflexed	White Patent to deflexed	Pink or near white Erect or slightly diverged	White with brown-red midwein Slightly deflexed
Mericarps		Lanceolate to narrowly oblong, 9–11 mm long, with conspicuous ridges	Prolonged ovoid, 9–11 mm long, with broad ridges	Narrowly ovate, 4–6 mm long, with five rounded, relatively broad ridges	Narrowly ovate, 7–8 mm long, with five indistinct, broad ridges	Narrowly ovate to lanceolate, 5–6 mm, slightly compressed laterally, with broad, rounded ridges

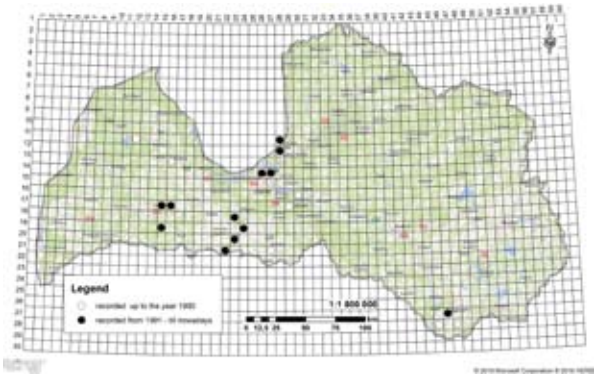

Fig. 3. Distribution of *Chaerophyllum bulbosum* L. in Latvia

Fig. 4. Fruits (mericarps): a) *Chaerohyllum temulum* L., b) *C. hirsutum.* L., c) *C. aureum* L., d) *C. bulbosusm* L. Photo: A. Rukmane

Chaerophyllum hirsutum L.

Perennial plant, native species known from south-east Latvia. The largest part of localities found in the ravines of small confluents of the River Daugava – forested floodplains, along streams, spring fens and other similar habitats. It was first identified in Latvia and collected in the herbarium in 1833 and re-inventoried in 1835 in the wood stream edge near Līksna by a famous botanist J. Fiedorowicz (Fig. 5). In the later studies, the species has not been identified at this site. In 1976, in the herbarium collected by Z. Šlangena near Šķaune, Dagda region (LATV 36791), mistakenly determined as *Anthriscus nitida* (Wahlenb.) Hazsl. by a Russian botanist Vadim Tihomirov. Later, nearly all collected herbaria of this species were identified incorrectly by this sample, except for one, collected in 2006 by Uvis Suško in a mixed spruce – deciduous forest border near Andrupene, Dagda municipality (DAU 59022001) (www.db.biology.lv).

The species in Latvia most likely has a dual status. In the south of Latvia, the autochthony of the species is undoubted, whereas the locality of *C. hirsutum* between allotments and the railway in the area of Ķemeri National Park near Sloka (Leg. A. Priede, DAU 59022008) is most probably of anthropogenic origin (Fig. 6, 7).

Chaerophyllum temulum L.

Biennial or sometimes annual plant (therophyte). In Latvia, it is considered to be a rare alien species. It was first identified in the state in Gelenova Park in 1967 (LATV 15094), where later the locality was checked and herbaria were collected several times – K. Birkmane in 1978, N. Priedītis in 1990, P. Evarts-Bunders in 2013 and 2015. Last search for his species shows that *C. temulum* forms sparse

Fig. 5. First herbarium and herbarium label of *Chaerophyllum hirsutum* L., collected in Latvia by J. Fiedorowicz, deposited at the Herbarium of Vilnius University (WI). Photo: U. Suško

Fig. 6. Blooming *Chaerophyllum hirsutum* L., near Krāslava. Photo: B. Bambe

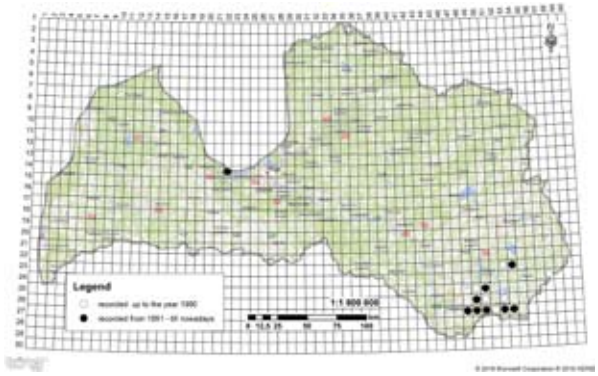

Fig. 7. Distribution of *Chaerophyllum hirsutum* L. in Latvia

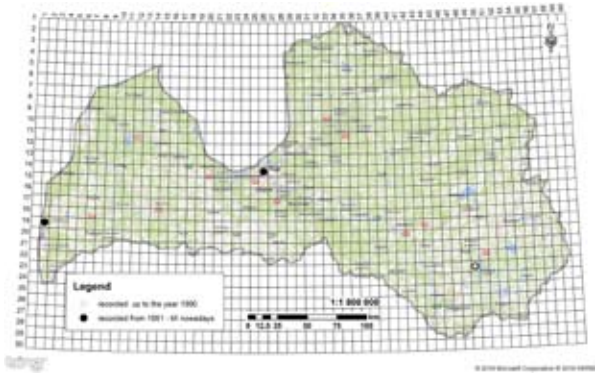

Fig. 8. Distribution of *Chaerophyllum temulum* L. in Latvia

groups (total area – 0.2 ha) in a fragmentary managed park.

In other parts of Latvia, it is known only from waste places and railway sides in Rīga and Liepāja (Fig. 8). In certain works it is considered as possibly native in the south-eastern part of Latvia, where it grows in forested ravines and slopes (Tabaka et al., 1982; Jankevičiene et al., 1996). However, a probable herbarium from natural biotopes has not been recorded, in the study area of this region the species has not been identified either, therefore, there is no reason to consider *C. temulum* as a Latvian autochthonous taxon.

DISCUSSION

The Apiaceae family is known as one of taxonomically most problematic and, to a large extent, this applies to the genus *Chaerophyllum*. In the Latvian scientific literature, there have been a lot of imprecise, incorrectly defined materials and the authors have been using the incorrect descriptions or mistakenly identified genus from work to work (Jankevičiene et al., 1996; Gavrilova & Šulcs, 1999; Priedītis, 2014). Thus, a necessity to provide a thorough study of the composition of the genus in the Latvian flora has become imminent.

Identification of species is primarily based on fruit characters (form and size of mericarps, fruit ridges, styles) and other generative structures – bracts, bracteoles (see Table 1, Fig. 4), therefore, incorrectly collected, sterile herbaria material cannot be identified correctly.

Since 1991, there have been numerous herbaria of the rare *Chaerophyllum* genus species collected, which considerably changes our ideas of the genus floristic composition in the state as well as of the regularity of the distribution of certain species. However, the data of only few studies have been published during this time, including new *C. hirsutum* localities and new species in Latvia – *C. aureum* lo-

calities (Priedītis, 2014; Evarts-Bunders & Evarte-Bundere, 2015; Baroniņa, 2015).

The analysis of the collected material as well as the revision of most known localities shows that our knowledge about distribution and floristic status of at least two *Chaerophyllum* species has been incomplete or even completely incorrect.

One of these species – *C. aureum,* known only from one locality in Latvia and Baltic countries in general – in Daugavpils city near Grīva Railway Station, for a long time has been incorrectly regarded as *C. hirsutum*. However, the biggest changes are related to *C. hirsutum.* On the whole, the species in Latvia has a history full of misunderstanding and mistakes, as it has long been misidentified and incorrectly defined with a wrong epithet in the scientific and popular scientific literature. In the Flora of Baltic Countries, *C. hirsutum* for Latvia and Lithuania were mentioned only in old literature (Jankevičiene et al., 1996). In later studies, the entire herbarium material that corresponds to the specimen defined by V. Tihomirov was identified as *Anthriscus nitida,* and was indicated even in the Red Data Book of Latvia (Fatare, 2003), the flora of the Baltic states and other floristic and related studies (Tabaka et al., 1982; Fatare, 1989, 1992; Jankevičiene et al., 1996; Bāra, 2010; Priedītis, 2014). All localities and herbarium material of *Anthriscus nitida*, previously known and collected in Latvia, after our critical revision are considered as *Chaerophyllum hirsutum*, whereas *Anthriscus nitida* at least in the Latvian flora has not been identified yet and has been removed from the flora lists as a mistake.

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NAUJOS ŽINIOS APIE *CHAEROPHYLLUM* (APIACEAE) GENTIES RŪŠIS LATVIJOJE

Pēteris Evarts-Bunders, Gunta Evarte-Bundere

Santrauka

Chaerophyllum gentis priklauso Apiaceae šeimai, kuri yra viena sudėtingiausių ir sunkiausiai apibūdintų genčių. Latvijoje yra žinomos penkios rūšys, kurių radimvietės patvirtintos herbarų medžiaga: *Chaerophyllum aromaticum* – vietinė rūšis, gana dažna miškuose, parkuose ir krūmynuose, *C. aureum* – antrapofitas, rastas tik vienoje vietoje Daugpilyje palei geležinkelį, *C. bulbosum* – antrapofitas, buvo auginamas kaip šakninė daržovė, o dabar retai aptinkamas parkuose, gyvenvietėse, palei šaligatvius, patvoriuose. *C. hirsutum* – vietinė rūšis, žinoma keliose vietovėse pietrytinėje Latvijos dalyje, daugiausia Dauguvos slėnyje, kur auga plačialapių miškų šlaituose. *C. temulum* – svetimžemė rūšis, žinoma tik keliose Latvijos vietovėse, auga sąvartynuose, geležinkelio pylimuose, senų dvarų parkuose. Labiausiai netikėti rezultatai buvo gauti tiriant *C. hirsutum* paplitimą Latvijoje. Pagal literatūrinius duomenis ir herbarinę medžiagą *Anthriscus nitida* buvo žinoma Latvijos floroje, tačiau po kritinio herbarų įvertinimo paaiškėjo, kad tai *C. hirsutum*. *Anthriscus nitida* buvo pašalinta iš Latvijos floros sąrašo, kai klaidingai buvo nustatyta rūšis.