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A review of the subtribe Centaureinae (Asteraceae, Cardueae) in Lithuania with information on new alien species

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Abstract

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The study's objective was to overview all Centaureinae species recorded in Lithuania, evaluate the distribution and population state of the newly discovered four alien species and provide information on the residence status, distribution and habitats occupied by all species of the subtribe. The subtribe Centaureinae in Lithuania is now represented by five genera: *Centaurea*, *Leuzea*, *Psephellus*, *Serratula* and *Zoegea*. The largest genus in the flora of the country is *Centaurea*, which includes four native and six alien species. The genus *Serratula* is represented by one native species, while the genera *Leuzea*, *Psephellus* and *Zoegea* each have one alien species. Tree alien species (an archaeophyte, *Centaurea cyanus*, and neophytes *Centaurea montana* and *Psephellus dealbatus*) are naturalised aliens, whereas *Centaurea cheiranthifolia*, *Centaurea diffusa*, *Centaurea iberica*, *Centaurea macrocephala*, *Leuzea repens* and *Zoegea crinita* are casual aliens. Five species of the subtribe Centaureinae (*Centaurea jacea*, *Centaurea phrygia*, *Centaurea scabiosa*, *Centaurea stoebe* and *Serratula tinctoria*) are native to Lithuania. Maps of the distribution of newly discovered alien species in Lithuania are presented.

Keywords: archaeophytes, casual species, *Centaurea*, distribution, *Leuzea*, native species, naturalised species, *Psephellus*, *Serratula*, *Zoegea*.

INTRODUCTION

Changes in biodiversity in certain areas are driven by natural and anthropogenic causes (Van Der Wal et al., 2008; Hautier et al., 2015). Among the most critical factors causing changes in modern species diversity are the loss of native species and the encroachment of alien species into new areas (Der Wal et al., 2008). The perception of biodiversity is also changing due to new taxonomic treatments of certain groups of organisms (McNeely, 2002). Plant taxonomy, including the family Asteraceae, has been subjected to many changes in recent decades (Rouhan & Gaudeul, 2014). Therefore, a reassessment of the diversity in the country is needed.

The tribe Cardueae Cass. (Asteraceae) has undergone significant taxonomic transformations over the last two decades (Greuter, 2003; Susanna et al., 2006; Herrando-Moraira et al., 2019). According to the currently accepted concept of tribe, it comprises 12 subtribes, including the subtribe Centaureinae Dumort. (Herrando-Moraira et al., 2019; CWG, 2021). Taxonomists made many attempts until the end of the 20th century to subdivide the broad genus *Centaurea* L. into smaller genera, but the attempts were controversial (Susanna et al., 1995; Garcia-Jacas et al., 2001). Therefore, the genus *Centaurea* and allied genera have been the subject of intense studies over the last few decades (Wagenitz & Hellwig, 2000; Su-

sanna et al., 2006; Garcia-Jacas et al., 2006; Font et al., 2009; Ferrer-Gallego & Altinordu, 2016; Arnelas et al., 2018; Hind, 2019). As a result, the broadly circumscribed polyphyletic genus *Centaurea* is divided into several putatively monophyletic genera (Wagenitz & Hellwig, 2000; Greuter 2003, 2006; Susanna et al., 2006; CWG, 2021; POWO, 2022).

The subtribe Centaureinae (according to its current circumscription) had formerly been represented in Lithuania by two genera, *Centaurea* L. (*Centaurea cyanus* L., *Centaurea jacea* L., *Centaurea phrygia* L., *Centaurea scabiosa* L. *Centaurea rhenana* Boreau, *Centaurea diffusa* Lam. and *Centaurea iberica* Trevis ex Spreng.) and *Serratula* L. (*Serratula tinctoria* L.) (Apalia, 1969; Lekavičius, 1980). Later, two more alien species belonging to the genera *Acroptilon* Cass. and *Zoegea* L. were included in the list of the flora (Gudžinskas, 1997, 1999). The study's objective was to overview all Centaureinae species recorded in Lithuania, evaluate the distribution and population state of the newly discovered four alien species, present information on the residence status, distribution and habitats occupied by all species of the subtribe, and provide a revised nomenclature of taxa.

MATERIALS AND METHODS

The research was carried out between 2005 and 2021 throughout Lithuania. Material on the distribution and diversity of the alien species concerned was collected as part of other plant diversity surveys, studies or habitat assessments. The collected herbarium specimens (see Appendix) are deposited at the Herbarium (BILAS) of the Institute of Botany of the Nature Research Centre, Vilnius. The present work adopts the latest taxonomy and nomenclature of the subtribe Centaureinae (CWG, 2021). The residence status of a species is determined according to the time of introduction of the species into the territory of Lithuania. Alien species introduced into the country's territory before the 1500s are called archaeophytes, while species introduced after the 1500s are considered neophytes (Pyšek et al., 2001, 2004).

The descriptions of the morphology of the species under study are based on the plant specimens collected and on the literature sources cited. Information on the anthropogenic range of the species in Europe and other regions was collected from cited literature sources. A map of the distribution of species was compiled by applying a grid system. All records in the same grid cell were marked with a single symbol.

RESULTS AND DISCUSSION

New alien species

Four new alien species of the subtribe Centaureinae were recorded in Lithuania during the study period. The name and main synonyms, morphological description and information on each newly discovered species' native and anthropogenic range are given. The currently known distribution of each species in the country is also assessed, as well as the population size, the habitats occupied, and the estimated level of naturalisation.

Centaurea cheiranthifolia Willd. in Phytographia, 1: 12. 1794. – *Cyanus cheiranthifolius* (Willd.) Soják in Čas. Nár. Mus. Odd. Prír., 140: 131. 1972.

Perennial, usually 40–70 cm tall herb with several unbranched or sparingly branched stems (Fig. 1).

Fig. 1. *Centaurea cheiranthifolia* in the environs of Tryškiai, Telšiai district, 2009 (photo by Z. Gudžinskas)

Stems and leaves are covered with short villous and arachnoid hairs or almost glabrous. The basal and lower cauline leaves are petiolate, oblanceolate to narrowly ovate leaf blades, 10–20 cm long. Cauline leaves are sessile, decurrent, and lanceolate, 5–10 cm long. Involucres ovoid, 15–25 mm in diameter. Phyllaries green, lanceolate, with brown or blackish appendages, white pectinate-fringed. Floret corollas white or creamy white, stamens purplish. Cypselae 5–6 mm long.

Centaurea cheiranthifolia is native to northern and eastern Turkey, the Caucasus and north-western Iran. This species has been recorded as an alien plant in Sweden (Greuter, 2006).

Centaurea cheiranthifolia was first found in Lithuania in 2009, 4 km southwest of Tryškiai, in the vicinity of Juodėnai village (Telšiai district), in a grassland of the River Virvyčia valley. Three clumps of this species were registered in abandoned mesophyte grassland. Another locality of *Centaurea cheiranthifolia* was recorded in 2019, 4 km east of Vilkija, in Padauguva village (Kaunas district), in a dry grassland by the road (Fig. 2). The stand of this species covered an area of ca. 1 m^2. The plants found in mid-June were in a phase of intense flowering at both sites.

Centaurea cheiranthifolia is sometimes grown in gardens as an ornamental plant. In the habitats where the species was recorded, underground parts of living plants or seeds may have been introduced with garden waste. The species may likely be found in other parts of the country, especially near urbanised areas. The species is currently considered to be casual in Lithuania but has the potential to naturalise locally. There is a low probability that the species could become invasive in the country.

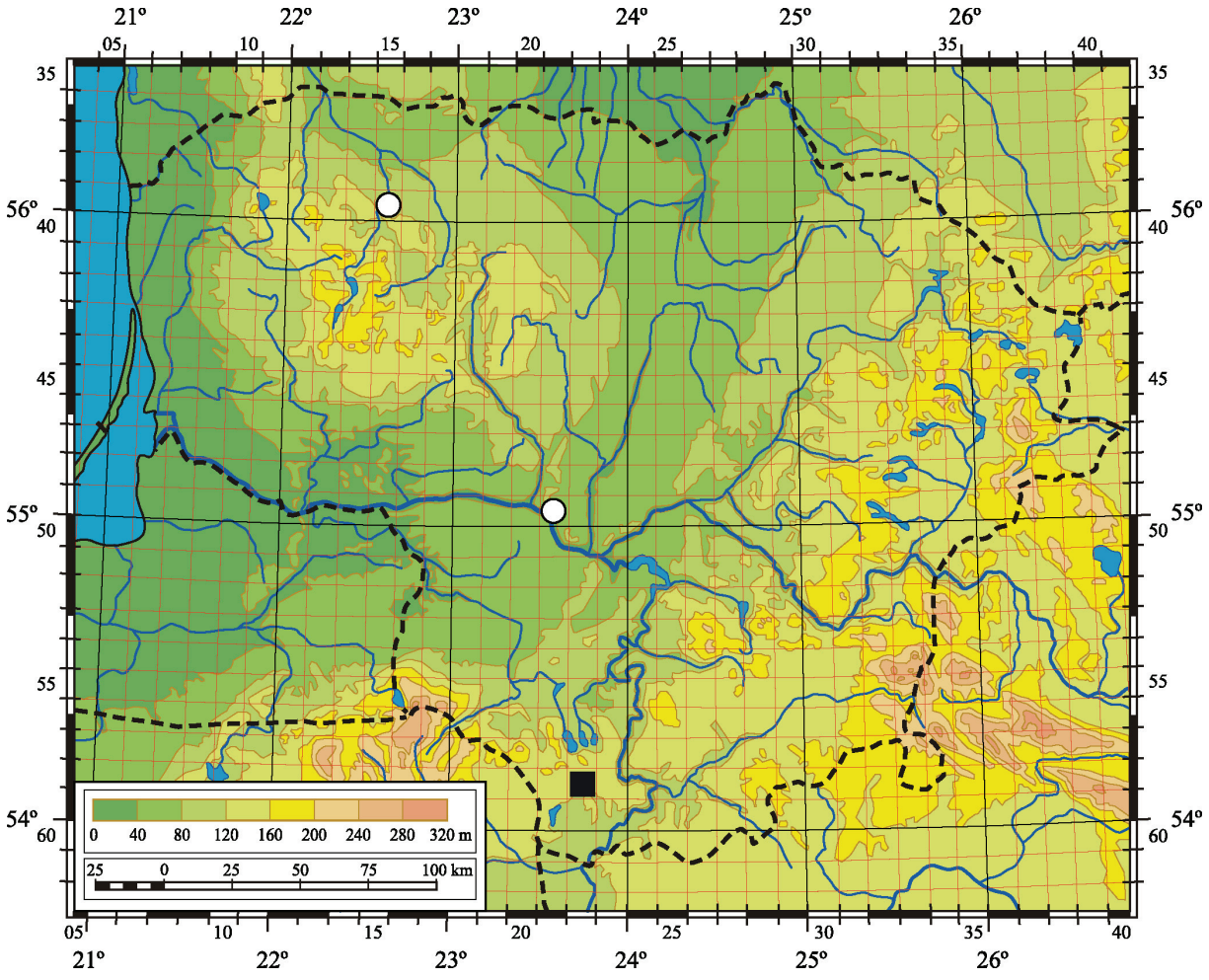

Fig. 2. Distribution of *Centaurea cheiranthifolia* (white dots) and *Centaurea macrocephala* (black square) in Lithuania

Centaurea macrocephala Muss. Puschk. ex Willd., Sp. Pl., ed. 4, 3: 2298. 1803. – *Grossheimia macrocephala* (Muss. Puschk. ex Willd.) Sosn. & Takht. in Dokl. Akad. Nauk Armyanskoi SSR, 3(1): 22. 1945.

Perennial, usually 50–120 cm tall herb with several erect, unbranched or sparingly branched stems (Fig. 3). Stems and leaves are covered with short villous and arachnoid hairs, occasionally almost glabrous, with resinous glands. The basal and lower cauline leaves are petiolate, oblanceolate to narrowly ovate leaf blades, 10–30 cm long, with entire or shallowly dentate margins. Cauline leaves are sessile, shortly decurrent, lanceolate to ovate, 5–10 cm long. Involucres ovoid to hemispheric, 25–35 mm in diameter, surrounded by 3 to 12 rows of layered phyllaries. Phyllaries are pale green or stramineous, ovate to broadly lanceolate, and glabrous. Phyllary appendages are erect to spreading, brown to golden, scarious, lacerate fringed. Floret corollas yellow. Cypselae 7–8 mm long, with 5–8 mm long pappus (Cullen, 2000; Keil & Ochsmann, 2006).

Fig. 3. *Centaurea macrocephala* in the environs of Seirijai, Lazdijai district, 2020 (photo by Z. Gudžinskas)

Centaurea macrocephala is native to Transcaucasia, north-eastern Turkey and north-western Iran (Greuter, 2006). As an alien plant, this species has been recorded in Finland (Kurtto et al., 2019), Poland (Łazarski & Pliszko, 2022), Great Britain (Clement & Foster, 1994), Belgium, Denmark (Verloove, 2021), the Czech Republic (Pyšek et al., 2012), Canada and the USA (Keil & Ochsmann, 2006).

Centaurea macrocephala was first found in Lithuania in 2020 (Ročkiai village, 3 km southwest of Seirijai, Lazdijai district; Fig. 2). Three small patches were recorded in a dry hillside meadow. Seeds or other propagules of *Centaurea macrocephala* have likely been introduced with the soil used to reclaim the road embankment.

Centaurea macrocephala is quite frequently cultivated as an ornamental plant. Therefore, it is likely that the number of localities will increase in the future. The species could naturalise locally in Lithuania, but is unlikely to become invasive. *Centaurea macrocephala* is currently classified as a casual species.

Centaurea montana L., Sp. Pl.: 911. 1753. – *Cyanus montanus* (L.) Hill, Hort. Kew. (Hill) ed. 1: 64. 1768.

Perennial, usually 25–80 cm tall, rhizomatous plant (Fig. 4). Stems erect, simple or slightly branched, villous with septate, arachnoid and simple hairs. Leaves are villous, tomentose or glabrate. Leaves winged-petiolate, 10–30 cm long, with entire or remotely dentate margins, occasionally pinnately lobed. Capitula borne singly or sometimes form corymbiform synflorescence. Involucres ovoid to campanulate, 20–25 mm in diameter. Outer phyllaries are greenish, ovate to lanceolate, with brown to black appressed appendages, pectinate-fringed. Innermost phyllaries are usually without appendages. Sterile florets 10–20, blue, 25–45 mm long. Disc florets 25–40 or more, purple, ca. 20 mm long. Cypselae 5–6 mm long. Pappus of 0.5–1.5 mm long bristles (Cullen, 2000; Keil & Ochsmann, 2006).

Centaurea montana is native to western and central Europe (Austria, Belgium, the Czech Republic, France, Germany, Italy, the Netherlands, Spain, and Switzerland) (Greuter, 2006). However, as an alien plant, this species has been recorded in northern and

Fig. 4. *Centaurea montana* in the environs of Varputėnai village, Šiauliai district, 2015 (photo by Z. Gudžinskas)

eastern Europe, Canada and the USA (Greuter, 2006; Keil & Ochsmann, 2006; Pyšek et al., 2012).

Centaurea montana was first recorded in Lithuania in 2005 (3 km north of Varputėnai, vicinity of Visdegiai village, in the Varputėnai Geomorphological Reserve, Šiauliai district). A dense thicket occupying ca. 8 m long and 6 m wide was found along the edge of *Alnus incana* stand, between an esker and a wetland. A decade later, in 2015, the thicket of *Centaurea montana* had significantly increased in the same location, extending along the edge of *Alnus incana* stand for ca. 20 m and covering an area of more than 120 m^2. Groups or stands of *Centaurea montana* of various sizes were recorded in Alytus, Lazdijai, Trakai, Švenčionys districts, and in the cities of Neringa and Vilnius (Fig. 5). *Centaurea montana* is now recorded in eight localities (see Appendix), where it grows along forest edges, wood-cutting areas, grasslands and anthropogenic habitats.

Centaurea montana is often grown as an ornamental plant in gardens in Lithuania. The assessment of the currently known occurrences of this species

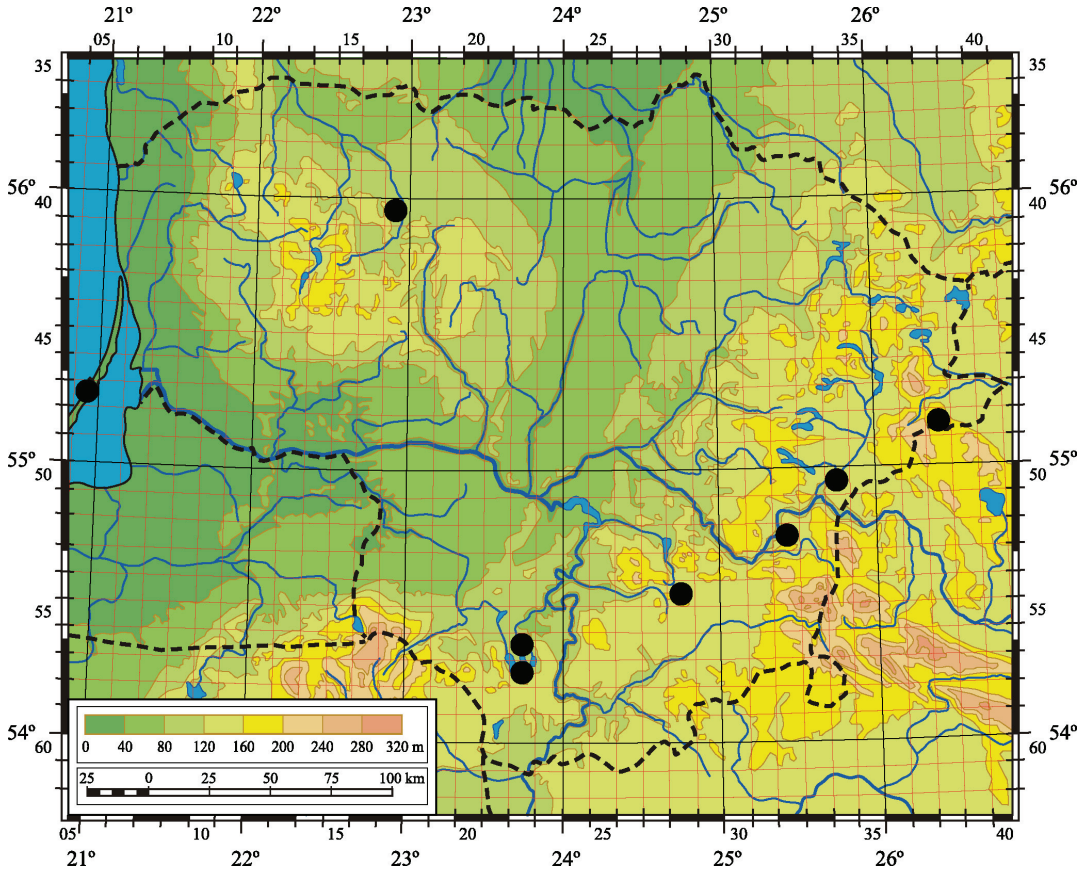

Fig. 5. Distribution of *Centaurea montana* (black dots) in Lithuania

suggests that, in most cases, the underground parts or seeds of plants may have been introduced with garden waste. The species may likely be found in other parts of the country in the future, particularly along woodlands close to urbanised areas. The development of the population monitored since 2005 and the status of other populations suggest that the species is now naturalised in Lithuania and has the potential to further spread. *Centaurea montana* may have localised impacts on plant communities and habitats due to its intensive vegetative reproduction and spread by rhizomes. Still, there is little likelihood of it becoming an invasive species.

Psephellus dealbatus (Willd.) K.Koch in Linnaea, 24: 438. 1851. – *Centaurea dealbata* Willd., Sp. Pl., ed. 4, 3: 2295. 1803.

Perennial, clump-forming, 50–70 cm tall, rhizomatous plant with erect or ascending stems (Fig. 6). Basal and lower cauline leaves are oblong, pinnately dissected, and upper cauline leaves lyrate. The upper side of the leaves is green, with arachnoid hairs, lower side is densely tomentose and white. Capitula 4–5 cm in diameter, usually solitary on the top of branches. Involucre oblong ovate, 1–1.5 cm in diameter. Outer phyllaries lanceolate, yellowish or brownish, with whitish, almost circular, fimbriate appendage. Florets lavender or pink, outer larger than inner. Cypselae are 5–6 mm long (Cullen, 2000).

Fig. 6. *Psephellus dealbatus* in the environs of Pociūnai village, Radviliškis district, 2017 (photo by Z. Gudžinskas)

Psephellus dealbatus is native to the Caucasus, Transcaucasia and Turkey (Greuter, 2006). As an alien plant, this species has been recorded in Austria, Belgium, the Czech Republic, Estonia, Wales, Great Britain and Poland (Kukk et al., 2003; Greuter, 2006; Pyšek et al., 2012; Verloove, 2021).

Psephellus dealbatus was first recorded in Lithuania in 2005, 2 km west of Pociūnai, in Valdeikiai village, near the road Panevėžys–Radviliškis (Radviliškis district). A dense clump of 2 m^2 was found in a mesophyte grassland near the edge of a cultivated field. Later, in 2017, an observation of the same locality revealed that a dense thicket of *Psephellus dealbatus* formed a strip of approximately 1.5 m wide and 3.5 m long between the mesophyte grassland and the crop field. Groups or stands of *Psephellus dealbatus* of various sizes were also recorded in Alytus, Kaišiadorys, Kaunas and Radviliškis districts (Fig. 7). This species is now recorded in six localities (see Appendix), where it grows in meadows, roadsides, slopes and wastelands.

Psephellus dealbatus is often cultivated in gardens as an ornamental plant in Lithuania. The assessment of the currently known localities of this species suggests that, in most cases, the underground parts of the living plants or seeds have been introduced with garden waste. At least at one site (Kaunas district), the species probably survive from former cultivation. The species may likely be recorded in other localities of the country in the future. The development of the population observed since 2005 in Radviliškis district, and the status of other populations suggest that the species is now naturalised in Lithuania and has the potential to continue its spread. The plants spread by rhizomes and form dense thickets, but the spread is slow. Large stands could have a localised impact on plant communities and habitats, but there is a low likelihood of this plant becoming an invasive species.

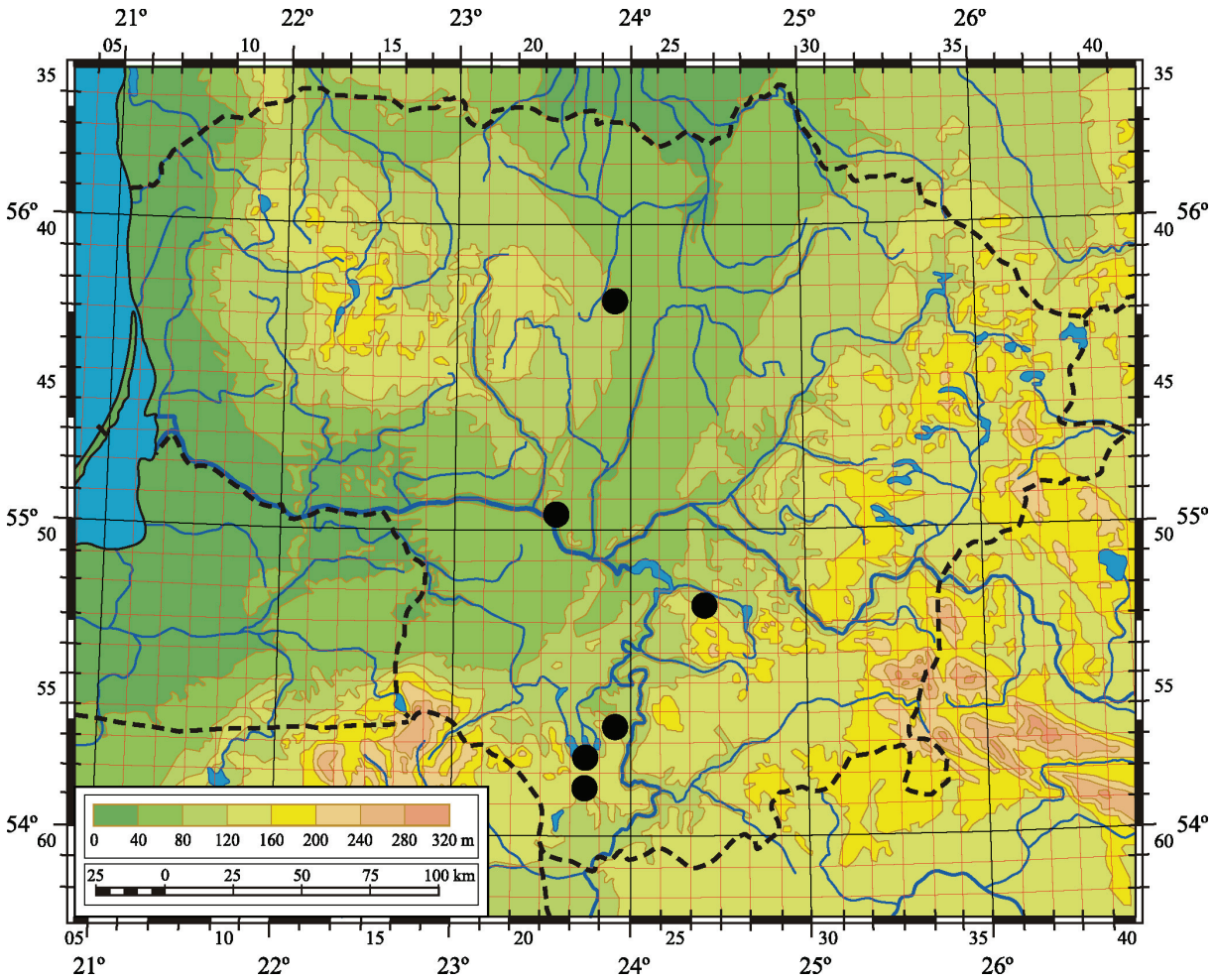

Fig. 7. Distribution of *Psephellus dealbatus* (black dots) in Lithuania

Notes on other alien species

Previously, four alien species of the subtribe Centaureinae were recorded in Lithuania, and one species, *Centaurea cyanus*, was treated as an archaeophyte or even native plant (Apalia, 1969; Lekavičius, 1980; Gudžinskas, 1997). Revised nomenclature of the taxa and information on the current status of alien species in the country is given below.

Centaurea cyanus L. Sp. Pl.: 911. 1753. – *Cyanus segetum* Hill in Herb. Brit., 1: 82. 1769.

Centaurea cyanus is native to the Central and East Mediterranean and is widely distributed as an alien plant elsewhere in the world (POWO, 2022). It is an archaeophyte in many parts of Europe and Asia, while on other continents, it has been introduced and naturalised in more recent historical periods (Bakels, 2012).

In many Central European countries, cereal cultivation is considered to have started in the Neolithic period, and it is assumed that *Centaurea jacea* was introduced to the region at that time (Bakels, 2012). However, recent studies suggest that agriculture in Lithuania was initiated later than previously thought, in the Bronze Age (about 3300 years ago), and cereal cultivation started in the whole East Baltics during this period (Grikpėdis & Motuzaitė Matuzevičiūtė, 2016, 2017). In later periods, *Centaurea cyanus* and cereal pollen or macrofossils were regularly found in sediment layers studied by geologists and at archaeological sites (Stančikaitė et al., 2009; Grikpėdis & Motuzaitė Matuzevičiūtė, 2017). The pollen fossils in the geological strata formed soon after deglaciation and identified as *Centaurea cyanus* probably belong to other species of this genus (Bakels, 2012).

Centaurea cyanus is widespread and frequent

throughout the country. It is a common weed of winter cereal crops and often grows in agricultural lands and other anthropogenic habitats (wastelands, roadsides, railways). In the second half of the 20th century, intensive use of herbicides in agriculture led to the species becoming much rarer. Still, it has recovered in many places, especially on extensive farms.

Centaurea diffusa Lam., Encycl., 1: 675. 1785. – *Acosta diffusa* (Lam.) Soják in Čas. Nár. Muz. Odd. Přír., 140: 133. 1972.

The species is native to south-western Europe, western Asia and the Caucasus (Greuter, 2006). It is an alien species in many parts of Europe and North America (Greuter, 2006; Keil & Ochsmann, 2006). *Centaurea diffusa* was first found in Lithuania in 1946, in Vilnius, in the territory of a railway station. Later, the species was recorded in Riešė (Vilnius district) in an abandoned gravel pit on a pile of grain waste (Apalia, 1969; Gudžinskas, 1997). *Centaurea diffusa* was found at two sites in the last few decades: Tauragė in 1999, in the railway station yard, and Vievis (Elektrėnai district) in 2002, on the dry slope of a railway embankment. In Vievis, the species was relatively abundant, but within a few years, it became extinct. This species has been accidentally introduced with imported grain, probably from south-eastern Europe. *Centaurea diffusa* is currently a casual species that could be reintroduced to Lithuania as an admixture of cultivated plant seeds or agricultural commodities. It may naturalise in anthropogenic habitats in the future.

Centaurea iberica Trevir. ex Spreng., Syst. Veg. ed. 16, 3: 406. 1826. – *Calcitrapa iberica* (Trevir. ex Spreng.) Schur, Enum. Pl. Transsilv.: 409. 1866.

Centaurea iberica is native to south-eastern Europe and south-western Asia (Greuter, 2006). This species has been recorded as an alien plant in parts of central, western and eastern Europe and the USA (Greuter, 2006; Keil & Ochsmann, 2006). *Centaurea iberica* was found only once in Lithuania, in the vicinity of Riešė (Vilnius district), in an abandoned gravel quarry, on a pile of grain waste (Apalia, 1969; Gudžinskas, 1997). It has been accidentally introduced with imported grain from south-eastern Europe. Casual species for which new introductions into Lithuania are unlikely.

Leuzea repens (L.) D.J.N.Hind in Kew Bull., 74(2) 20: 2. 2019. – *Centaurea repens* L., Sp. Pl., ed. 2. 2: 1293. 1763. – *Acroptilon repens* (L.) DC., Prodr., 6: 663. 1838. – *Rhaponticum repens* (L.) Hidalgo in Ann. Bot. (Oxford), n.s., 97: 714. 2006.

Leuzea repens, widely known as *Acroptilon repens*, is native to south-eastern Europe, western and Central Asia and West Himalayas. The species is naturalised in many parts of Europe, North America and Australia, and in some places, it is considered invasive (Greuter, 2006; Hind, 2019). *Leuzea repens* was found once in Lithuania, in Vilnius, on the slope of a railway embankment (Gudžinskas, 1997). It has been accidentally introduced with grain, probably imported from south-eastern Europe. *Leuzea repens* is a casual species that could be reintroduced to Lithuania as a seed admixture of cultivated plants, but naturalisation is unlikely.

Zoegea crinita Boiss. subsp. ***baldschuanica*** (C.Winkl.) Rech.f., Fl. Iranica, 139b: 425. 1980. – *Zoegea baldschuanica* C.Winkl. in Trudy Imp. S.-Peterburgsk. Bot. Sada, 9: 426. 1886.

Zoegea crinita subsp. *baldschuanica* is native to Iran, Iraq, Pakistan, Tadzhikistan, Turkmenistan, Uzbekistan and Afghanistan (CWG, 2022). *Zoegea crinita* subsp. *baldschuanica* was found once in Lithuania, in Giruliai (Klaipėda district), between railway tracks (Gudžinskas, 1997). It has been accidentally introduced with imported grain from Central Asia. *Zoegea crinita* subsp. *baldschuanica* is a casual plant for which new introductions into Lithuania and naturalisation are unlikely.

Notes on native species

Centaurea jacea L., Sp. Pl.: 914. 1753. – *Centaurea pratensis* (Lam.) Salisb. in Prodr. Stirp. Chap. Allerton: 208. 1796. – *Jacea pratensis* Lam., Fl. Franç. 2: 54. 1779. – *Rhaponticum jacea* (L.) Scop., Fl. Carniol., ed. 2, 2: 136. 1771.

Centaurea jacea is common and widespread throughout the country. It mainly occurs in mesic grasslands, but also frequently in other grasslands, along forest edges, in sparse woodlands and anthropogenic habitats. *Centaurea jacea* is a highly polymorphic species, but only the type subspecies, *Centaurea jacea* subsp. *jacea*, has been recorded in Lithuania so far.

Centaurea phrygia L., Sp. Pl.: 910. 1753. – *Jacea plumosa* Lam., Fl. Franç. 2: 51. 1779.

Centaurea phrygia is a rare species in Lithuania, occurring more frequently in the western and northern parts, and only isolated localities have been recorded in other parts of the country. The species is assessed as near threatened (Petrulaitis, 2021) and included in the List of Protected Species of Lithuania (Įsakymas, 2020). It grows in sparse forests, along forest edges, in woodland clearings, and rarely occurs in grasslands. In Lithuania, this species is represented only by the type subspecies, *Centaurea phrygia* subsp. *prygia*, whereas occasionally reported *Centaurea phrygia* subsp. *pseudophrygia* (C.A.Mey.) Gugler in the Baltic Region, has been recorded in Estonia only (Kukk et al., 2003).

Centaurea scabiosa L., Sp. Pl.: 913. 1753. – *Lopholoma scabiosa* (L.) Cass. in G.-F.Cuvier, Dict. Sci. Nat., ed. 2, 44: 37. 1826. – *Sagmen scabiosa* (L.) Hill in Hort. Kew.: 66. 1768. – *Phrygia major* Gray in Nat. Arr. Brit. Pl. 2: 441. 1821.

Centaurea scabiosa is a species distributed throughout Lithuania, but is more frequent in the southern and eastern parts of the country. In contrast, in the northern region, it occurs quite sporadically. This species grows in dry and mesic grasslands, especially on hillsides, along dry forest edges and in sparse woodlands, and often occurs in various anthropogenic habitats (on slopes of embankments, along roads, in wastelands and quarries).

Centaurea stoebe L., Sp. Pl.: 914. 1753. – *Acosta stoebe* (L.) Soják in Cas. Nár. Mus. Odd. Prír., 140: 134. 1972. – *Centaurea maculosa* Lam., Encycl., 1: 669. 1785. – *Centaurea rhenana* Boreau, Fl. Centre France, éd. 3, 2: 355. 1857. – *Acosta rhenana* (Boreau) Soják in Cas. Nár. Mus. Odd. Prír., 140: 134. 1972.

Centaurea stoebe, formerly in Lithuania referred to as *Centaurea rhenana* Boreau or *Centaurea maculosa* Lam., is native to the southern, eastern and western parts of the country, where sandy and sandy loam soils predominate. In the central and northern parts of Lithuania, the species occurs only in heavily disturbed habitats, and its populations are probably of anthropogenic origin. It grows in sand, dry grassland, continental and coastal dunes, and in various anthropogenic habitats (railway embankments, roadsides, wastelands, sand and gravel quarries).

Plants occurring in Lithuania belong to the type subspecies, *Centaurea stoebe* subsp. *stoebe*, whereas *Centaurea stoebe* subsp. *australis* (Pančić ex A.Kern.) Greuter has not yet been found, despite intensive searches throughout the country. This subspecies is expected in Lithuania as it occurs in many Central European countries (Rosche et al., 2018).

Serratula tinctoria L., Sp. Pl.: 816. 1753.

Serratula tinctoria is a species with a very uneven distribution in Lithuania. It is quite frequent in the western and south-western parts of the country, relatively rare in the south-eastern part, irregular in the north-eastern region, and absent in the northern districts. *Serratula tinctoria* grows in mesic and moderately humid grasslands, along forest edges, in sparse woodlands and in wooded pastures. A decline in populations has been observed, but detailed surveys of population status are needed to assess the need for the species' conservation.

CONCLUDING REMARKS

The subtribe Centaureinae in Lithuania is now represented by five genera: *Centaurea* L., *Leuzea* DC., *Psephellus* Cass., *Serratula* L. and *Zoegea* L. The largest genus in the flora of the country is *Centaurea*, which includes four native (*Centaurea jacea*, *Centaurea phrygia*, *Centaurea scabiosa* and *Centaurea stoebe*) and six alien (*Centaurea cheiranthifolia*, *Centaurea cyanus*, *Centaurea diffusa*, *Centaurea iberica*, *Centaurea macrocephala*, *Centaurea montana*) species. The genus *Serratula* is represented by one (*Serratula tinctoria*) native species, while the genera *Leuzea*, *Psephellus* and *Zoegea* each have one alien (*Leuzea repens*, *Psephellus dealbatus*, *Zoegea crinita*) species.

According to the most recent evidence, *Centaurea cyanus* may have been introduced to the present territory of Lithuania in the Bronze Age, when agriculture and cultivation of cereal crops began. According to the currently accepted concept, this species is naturalised in Lithuania and belongs to the group of archaeophytes. Most of the other alien species of the genus *Centaurea* are casual (*Centaurea cheiranthifolia*, *Centaurea diffusa*, *Centaurea iberica*, *Centaurea macrocephala*), while *Centaurea montana* is naturalised and tends to spread. *Psephellus dealbatus* should also be considered a naturalised species in Lithuania.

Leuzea repens and *Zoegea crinita* are casual species recorded only once in the country.

Considering a relatively large number of species of the genus *Centaurea* and related genera are cultivated in Lithuania for ornamental purposes, the number of alien species of the subtribe Centaureinae may increase.

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APPENDIX

List of herbarium specimens of newly discovered species

Centaurea cheiranthifolia Willd.

Telšiai distr., 4 km southwest of Tryškiai, environs of Juodėjai village, in the valley of the River Virvyčia; in an abandoned mesic grassland; three clumps; 56.03214 °N, 22.53505 °E; 19 June 2009, leg. et det. Z. Gudžinskas. 3915.

Kaunas distr., 4 km east of Vilkija, Padauguva village, at a road; in a dry meadow, ca. 1 m^2; 55.04022 °N, 23.66255 °E, 11 June 2019; leg. et det. Z. Gudžinskas. 4921.

Centaurea macrocephala Muss. Puschk. ex Willd.

Lazdijai distr., 3 km southwest of Seirijai, Ročkiai village, in a dry grassland on the slope, near the road, three individuals; 54.21840 °N, 23.77050 °E, 17 July 2020; leg. et det. Z. Gudžinskas. 5822.

Centaurea montana L.

Šiauliai distr., 3 km north of Varputėnai, environs of Visdergiai village, the Varputėnai Geomorphological Reserve, between the esker and wetland, in grey alder stand and along its edge, dense stand 8 m long and 6 m wide; 55.90498 °N, 22.90088 °E, 21 June 2005; leg. et det. Z. Gudžinskas. 4017.

Šiauliai distr., 3 km north of Varputėnai, environs of Visdergiai village, the Varputėnai Geomorphological Reserve, between the esker and wetland, in grey alder stand and along its edge, dense stand 20 m long and 6 m wide; 55.90498 °N, 22.90088 °E, 10 June 2015; leg. et det. Z. Gudžinskas. 4017.

Lazdijai distr., Meteliai Regional Park, Šilas Forest; in a damp grassland at the edge of forest cutting area, ca. 1.5 m^2; 54.28677 °N, 23.81407 °E, 2 June 2015; leg. et det. Z. Gudžinskas. 5722.

Vilnius, Rokantiškės, environs of Rokantiškės Cemetery at Viršupis str.; on the edge of wooded area; several individuals; 54.70793 °N, 25.35902 °E, 20 May 2018; leg. et det. Z. Gudžinskas. 5232.

Neringa, Curonian Spit National Park, at the southern edge of Nida, in front of Parnidis dune, Tyla valley; in a wet grassland among shrubs, dense, ca. 2 m^2 stand. 55.29706 °N, 20.99643 °E, 2 June 2018; leg. et det. Z. Gudžinskas. 4705.

Trakai distr., 9.5 km southeast of Aukštadvaris, Aukštadvaris Regional Park, Lausgeniai village, at the cemetery; in a dry meadow on the edge of woodland, dense stand, ca. 4 m^2. 54.54927 °N, 24.67028 °E, 10 June 2015; leg. et det. Z. Gudžinskas. 5428.

Švenčionys distr., Daukšiškė village, in a dry grassland by the cemetery, 2 m^2 stand. 55.172995 °N, 26.388619 °E, 28 July 2020; leg. et det. L. Petrulaitis. 4838.

Alytus distr., 2 km northwest of Kumečiai, Atesninkai village, several individuals in a ditch at the road. 54.36198 °N, 23.72616 °E, 8 July 2020; leg. et det. Z. Gudžinskas. 5622.

Švenčionys distr., 4 km south of Pabradė, Karkažiškės village, in a grassland on the dry slope, three small patches. 54.95240 °N, 25.74640 °E, 28 June 2021; leg. et det. Z. Gudžinskas. 5034.

Psephellus dealbatus (Willd.) K.Koch

Radviliškis distr., 2 km west of Pociūnai, Valdeikiai village, on the right side of the road Panevėžys–Šiauliai; in a mesic meadow along the arable field, dense stand occupying 2 m^2; 55.77868 °N, 23.92237 °E; 27 June 2005; leg. et det. Z. Gudžinskas. 4223.

Radviliškis distr., 2 km west of Pociūnai, Valdeikiai village, on the right side of the road Panevėžys–Šiauliai; in a mesic meadow along the arable field, dense stand 3.5 m long and 1.5 m wide; 55.77868 °N, 23.92237 °E; 24 June 2017; leg. et det. Z. Gudžinskas. 4223.

Kaišiadorys distr., 2 km southwest of Žiežmariai, Mediniai Strėvininkai village, at the cemetery; in a dry meadow, at the edge of a slope, 1 m^2 stand; 54.79951 °N, 24.41376 °E, 6 May 2019; leg. et det. Z. Gudžinskas. 5226.

Kaunas distr., 4 km east of Vilkija, Padauguva village, at a road; in a dry meadow, ca. 6 m^2; 55.04023 °N, 23.66278 °E, 11 June 2019; leg. et det. Z. Gudžinskas. 4921.

Lazdijai distr., 3 km southwest of Seirijai, Ročkiai village, in a dry grassland on the slope, ca. 12 m^2; 54.21840 °N, 23.77050 °E, 17 July 2020; leg. et det. Z. Gudžinskas. 5822.

Lazdijai distr., Seirijai, eastern outskirts of the village, near the cemetery, in dry grassland, three stands occupying 8 m^2, 2 m^2 and 1 m^2. 54.22857 °N, 23.82452 °E, 14 July 2020; leg. et det. Z. Gudžinskas. 5722.

Alytus distr., Talokiai, at the road to Norūnai, along the edge of shrubland, a dense stand occupying ca. 10 m^2. 54.34111 °N, 23.96245 °E, 9 July 2020; leg. et det. Z. Gudžinskas. 5623.