

STUDIES ON THE SPECIES OF *RANUNCULUS AURICOMUS* COMPLEX IN THE FLORA OF LATVIA *RANUNCULUS AURICOMUS* GROUP: SPECIES WITH HAIRY RECEPTACLES

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Abstract

Traditionally, all authors in Latvia summarize all taxa of *Ranunculus auricomus* complex under three species, *R. auricomus* L., *R. fallax* (Wimm. et Grab.) Sloboda and *R. cassubicus* L. However, there is a lot of compelling studies, that *R. auricomus* complex is a large assembly of apomictic microspecies. In this article, 18 species – first part – species with sparsely to densely hairy receptacle of the *R. auricomus* group in Latvia are presented: *R. acutiussculus* (Markl.) Ericcs., *R. amblyodon* (Markl.) Ericcs., *R. atriviolacens* (Markl.) Ericcs., *R. basitruncatus* Borch.–Kolb, *R. brunnescens* (Markl.) Ericcs., *R. euryphyllarius* (Markl.) Ericcs., *R. glaucescens* (Markl.) Ericcs., *R. gyratidens* (Markl.) Ericcs., *R. integerrimus* (Julin) Borch.–Kolb, *R. linkolae* (Markl.) Ericcs., *R. macrophyllarius* (Markl.) Ericcs., *R. marklundii* (Julin & Nannf.) Ericcs., *R. obtusidents* (Julin) Ericcs., *R. obtusulus* Markl., *R. oligandrus* (Markl.) Ericcs., *R. orbicans* (Markl.) Ericcs., *R. pullus* (Markl.) Ericcs. and *R. stenodon* (Markl.) Ericcs.

Keywords: *Ranunculus auricomus*, goldilocks buttercup, flora, apomictic microspecies, Latvia.

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INTRODUCTION

The genus *Ranunculus* L. comprises about 600 herbaceous species with a cosmopolitan distribution (Tamura 1995, Emadzade et al. 2011) and at least 700 agamic microspecies –

only in Scandinavia 605 apomictic *Ranunculus auricomus* group species have been recorded as a new taxa (Ericsson 2001). It is the largest genus of *Ranunculaceae* and ranges among the 50 biggest genera of angiosperms (Frodin 2004). *Ranunculus* has its greatest diversity in

the submeridional to temperate zones of both hemispheres, and in high mountain systems (Emadzade et al. 2011, Emadzade & Hörandl 2011).

In Central Europe, the *Ranunculus auricomus* complex has gained increasing interest in recent years (Dunkel 2010, 2014, 2019, Hörandl & Gutermann 1998a, 1998b, 1998c, Hörandl et al. 2009). The *Ranunculus auricomus* aggregate species is a Central and Eastern European group of apomictic and partially sexual taxa. Traditionally, all authors in Latvia summarize all agamic species of this complex under three complex species, *R. auricomus* L., *R. fallax* (Wimm. et Grab.) Sloboda and *R. cassubicus* L. (e.g., Pētersone & Birkmane 1980, Gavrilova & Šulcs 1999, Priedītis 2014). However, there are lots of compelling studies, that *R. auricomus* complex is a large assembly of apomictic microspecies. Since the first reports on apomixis in the *R. auricomus* complex by Rožanova (1932) there have been many investigations regarding the species spectrum in several European countries, and, as a result – apomictic *R. auricomus* species are more appropriately described as a number of separate microspecies representing fixed basic evolutionary units characterized by internal constancy of features (e.g. Borchers-Kolb 1983, 1985, Ericsson 1992, 2001, Hörandl & Gutermann 1998a, Hörandl & Greilhuber 2002).

However, only in some areas microspecies of the *R. auricomus* complex may be considered to have been described completely and covered by long-term studies, such as Austria (Hörandl & Gutermann 1998a, 1998b, 1998c, 1999), Bavaria (Borchers-Kolb 1983, 1985, Dunkel 2005b, 2005c), northern parts of Italy (Dunkel 2005a, 2010), Alsace (Dunkel 2014), Slovenia (Dunkel 2019), Finland (Marklund 1940, 1961, 1965, Cedercreutz 1965, Fagerström 1965, 1974, 1976, Valta 1968, Fagerström et al. 1975), Sweden (Julin 1963, 1966, 1980) and partially some other countries (Russia, Poland). Data for other parts of the total range of the complex varies from incomplete to none. For instance, in Latvia and in the Baltic States overall, such

studies even at a very preliminary level have never been done before.

The *R. auricomus* species complex belongs to *R. auricomus* group comprises about 800 taxa distributed throughout Greenland, Europe (from the arctic zone to the Mediterranean region), Western Siberia, Central Asia and Alaska (Jalas & Suominen 1989, Hörandl et al. 2009, Dunkel 2015). Which concerned to the *R. auricomus* complex in Latvia, it is worth exploring for several reasons. Latvia and other Baltic States are situated on the border of the European, Scandinavian and Western Russia, and even Siberian species distribution ranges. At the same time – Baltic region is an ancient agricultural land with ancient transport routes; this means that the flora is relatively rich here and agamic species from all these floristic areas can be found here. Latvia is not strictly isolated by any geographical barriers, and no fully endemic plant species are known here. Flora does not develop here like in ‘glass ball’, and it can be easily predicted, that *R. auricomus* group species, described in Finland (Marklund 1961, 1965, Valta 1968, Fagerström 1965, 1974, 1976, Fagerström et al. 1975), Sweden (Julin 1963, 1966, 1967, 1980, Julin & Nannfeldt 1966) and Russia (Tzvelev 1994, 2001, 2012), initially described as infraspecific rank taxa, later – as species, abundantly should be found here.

Critical study of herbaria specimens from Latvia and all Baltic States showed many cases of misidentifications within the species complex of *R. auricomus*, as well as it indicated a high level of morphological and ecological diversity within this group, and it all lead to the necessity to update and clarify the species composition of *R. auricomus* complex and its distribution patterns in Latvia.

MATERIALS AND METHODS

During our studies, more than 3000 herbaria units of *R. auricomus* group species have been collected in Latvia. Material collected in the whole territory of Latvia during numerous field trips since 2016 was studied (Fig.1). The floristic

diversity of *R. auricomus* group was studied with an emphasis on suitable habitats – different grassland and forest habitats, including protected European habitats – 6270 *Fennoscandian lowland species-rich dry to mesic grasslands*, 6410 *Molinia* meadows on calcareous or peaty soils, 6510 *Northern boreal alluvial meadows*, 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior**, etc., as well as different types of anthropogenically impacted habitats – ruderal places, gardens and roadsides. Special attention was paid to old manor parks and other dendrological plantations, botanical gardens and arboretums. Many of them have a long-term continuity and with an excellent nemoral grass layer with co-dominance of *R. auricomus* s.l.

Comprehensive revision of major herbaria in Latvia – Daugavpils University, Institute of Life Sciences and Technology, Laboratory of Botany (DAU, appr. 3000 herbaria specimens, most of which collected by authors during previous years), University of Latvia, Institute of Biology, Laboratory of Botany (LATV, appr. 300 herbaria specimens) was carried out during this study. Additionally, data were obtained

from foreign herbarium – Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Department of Botany (TAA).

This study is a part of research on agamic complex of genus *Ranunculus* in Latvia. In this case we consider it appropriate to maintain more or less similar research methodology of all articles in this cycle (Evarts-Bunders et al. 2021). Special terminology, definitions and morphological characters – morphology of basal and cauline leaf, morphology of basal leaf blade: lobed, divided, dissected, degree of incision, etc., morphology of reproductive organs: receptacle, carpellophores are used by Dunkel (2005a, 2010, 2019).

Opinion of authors differs on the priorities for the importance of choosing different characters. Jasiewicz (1956), Tzvelev (1994, 2001) and most Scandinavian experts stated that characters present during anthesis – the period during which a flower is fully open and functional should be given priority in distinguishing microspecies. More generally, several authors

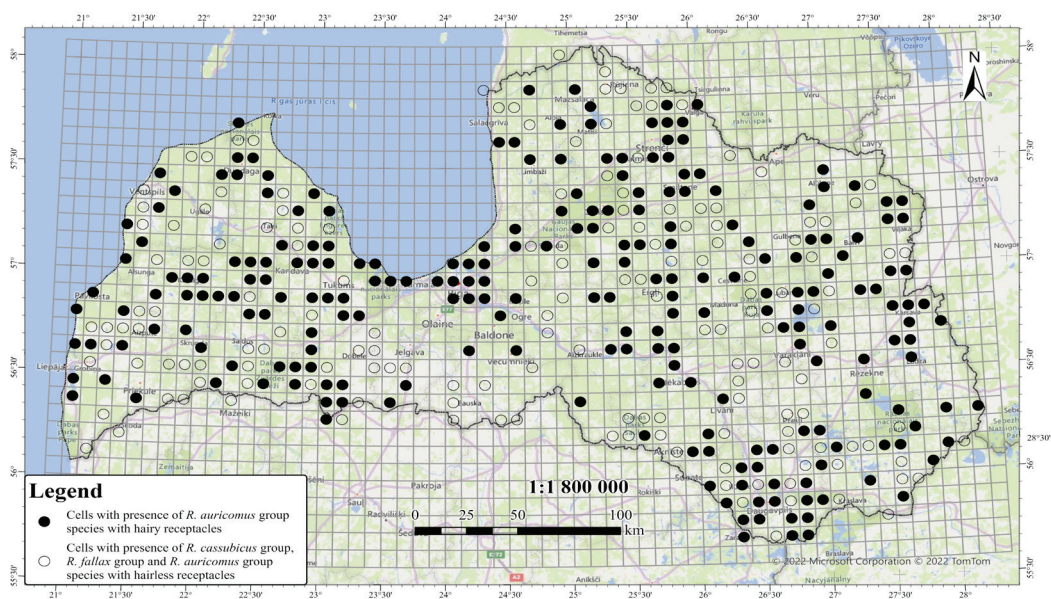


Figure 1. Map of geobotanical grid cells of Latvia with studied cells of *Ranunculus auricomus* complex species.

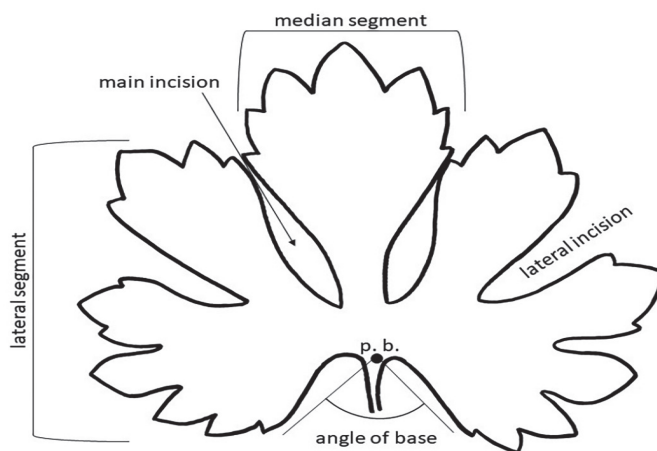


Figure 2. Basal leaf of *Ranunculus auricomus* s.l. – schematic diagram illustrates the most important characteristics: the length and the width of a leaf; the mode of division of main segments, the basal point (p.b.) is defined by junction of the main leaf veins; the angle of the base is measured from the basal point.

(Jasiewicz 1985) were of the opinion that presence or absence of cataphylls is a first-order systematic criterion. However, according to Ericsson (2001) characters present in the fruiting stage (shape and pilosity of the receptacle) are taxonomically useful, whereas the number and form of petals and the presence or absence of cataphylls may be misleading. In our work we hold to the similar views. Another approach requires use of all leaf cycles, including first, juvenile and later, summer leaves in description and identification of *R. auricomus* microspecies (e.g. Dunkel 2010, 2019). Our approach was that plants must be recognizable in the herbarium stage, otherwise, scientific collections can lose their relevance, and therefore characters present during anthesis were preferred in this work. Most important groups of characters:

1. **Habitus.** According to the size of the flowering shoot and the diameter of the stalk, the plants are divided into: gracile (height of 10–20 cm, diameter of stalk 1 mm), slim (height 20–40 cm, diameter – 1,5–2,5 mm) or robust (height 41–60 cm, diameter – 3–5 mm).
2. **Basal leaves.** Well-established fact, that this character is the most important in the

R. auricomus complex (Fig. 2). The cycle of the basal leaves consists of four, five, seldom six or mostly seven leaves. The leaf blades were described by the angle of the base (aperture), mode of division (dissected (100%), divided (66–99%), cleft (33–65%), lobed (25–32%), undivided (0–24%), the form of leaf edge, and form of central or middle lobe, etc. Main identification characters are described for the latest developed leaves in the leaf cycle during anthesis.

3. **Cauline leaves.** Important characters are the ratio of length/width (linear, lanceolate, oblanceolate or rhomboidal, number and shape of teeth as well as the leaf attachment type to the stem (sessile, subsessile or petiolate).
4. **Generative characters.** The number, length and level of development of the petals are characteristic for identification. In all diploid (and sexual) species, the flowers consist of five (rarely 6–7) well-developed petals, form apomictic asexual species corolla that is partially or fully reduced. More important are the characters of the gynoclinium (the main part of receptacle): size, shape and

hairiness. Another important distinctive character is the length of the carpellophores (short – up to 0,2 mm, long – up to 0,4 mm and longer).

All characters must be checked several times, if possible. It is necessary to collect more than one herbarium from one population, better at least 4–5, if it is possible. Specimens should be carefully selected to show the full range of basal leaf form. Atypical plants, growing in dense shade, poor substrate, grazed or mowed, often have no characteristic basal leaves and other characters, they can be poorly developed and even the latest leaves can be atypical. As a result – they will often be difficult or impossible to determine.

Species distribution maps for Latvia 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 or 71 km². The total number of the grid cells in Latvia is 1017, from which 822 are completely located and 195 are partially located in the territory of Latvia (Tabaka et al. 1980). To describe the distribution of the species frequency of occurrence, the standardized frequency rating scale developed for flora analysis in Latvia was used. The scale is based on the number of grid cells in which the species has been found – very rare (1–10 grid cells), rare (11–30), relatively rare (31–100), not very common (101–250), fairly common (251–500), common (501–750), very common (more than 751) (Fatara 1992).

All collected and cited herbarium specimens are deposited at the Herbarium of Daugavpils University, Institute of Life Sciences and Technology (DAU) and registered in the database of the Herbarium Universitatis Daugavpilensis (Evarde-Bundere et al. 2020).

RESULTS

The *R. auricomus* group is a catch-all assembly composed of what is left after the other groups have been segregated (Ericsson 1992). It is more

diverse than the other groups combined, and work on further subdivision not fully completed for territory of Latvia and refinement needs to be continued. Therefore, *R. auricomus* group is considered to be artificial and used mainly for simplification of identification.

In distinguishing species of *R. auricomus* group, we were guided by following morphological characters, which separates relatively this informal group from other groups of *R. auricomus* complex: mainly linear or linear-lanceolate cauline leaves with whole leaf blades or sometimes with one or few teeth; full number (6–7) of basal leaves with typically trilobate or divide leaf blade with divided or whole lateral segments. At the same time, some of the most developed basal leaves or even all leaves of basal leaf cycle can be with nearly whole leaf blade. Hairiness of receptacle at different intensities for species of this group is a one of typical character. Here, however, must be noted, that hairs on receptacles for some species (for instance, *R. glaucescens*, *R. brunnescens*, *R. gyatidens*) is very sparse and cursory assessment can be incorrect. We consider these morphological characters to be formal, as for several species these characters overlap with similar characters of *R. fallax* or even *R. cassubicus* group.

There were 18 *R. auricomus* group species with hairy receptacles found during our studies. As the species are morphologically very similar, identification of this group by classical dichotomous keys is almost impossible. For best results evaluation of several morphological characters at the same time is recommended. To determine these species, we offer to use comparative table of morphological characters, given in this work (see Table 1.). Thus, only short descriptions of species – explanation of the main characters and differences from nearest species are given, as well as main facts of species distribution and habitats in Latvia.

***Ranunculus acutiusculus* (Markl.) Ericss.** 1992, Svensk Bot. Tidskr. 86: 78. (Fig. 3.)
– *Ranunculus auricomus* subsp. *acutiusculus* Markl. 1961. Fl. Fenn. 3: 12.

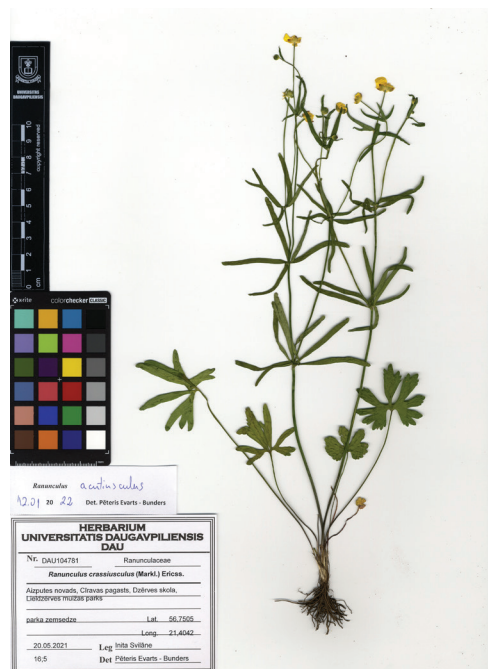


Figure 3. *Ranunculus acutiussculus* (Markl.) Ericss.



Figure 4. *Ranunculus amblyodon* (Markl.) Ericss.

Most important morphological characters: Medium-sized (slim) plant with toothless, linear cauline leaves and small to medium-sized most developed basal leaves with angle 60–120° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, lateral and main segments sessile without well-developed petioles. Flowers with fully or nearly fully reduced petals.

Distribution and ecology in Latvia: Occurs quite common in the whole territory of Latvia. Grows in mostly in different types of meadows (pastures, alluvial), old manor parks and other anthropogenic habitats. One of the commonest species of this group in Latvia.

***Ranunculus amblyodon* (Markl.) Ericss.** 1992. Ann. Bot. Fenn., 29(2): 130. (Fig. 4.)
– *Ranunculus auricomus* subsp. *amblyodon* Markl. 1961. Fl. Fenn. 3: 18.

Most important morphological characters: Slim plant with linear toothless cauline leaves

and small to medium-sized most developed basal leaves with angle 20–80° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, only most developed basal cycle leaves with fully dissected main segments lateral and main segments sessile. Flowers with nearly of fully developed petals.

Distribution and ecology in Latvia: Occurs rare and unequally – mainly in eastern part of Latvia – Latgale. Grows mostly in alluvial forest and parks (Bolupe, Ruskulova park, Malnava manor park, Lubāna wetland area, Palmene and Mazsalaca parks). Furthest to the west in Latvia – Ēbelmuiža park in Rīga.

***Ranunculus atriviolacens* (Markl.) Ericss.** 1992. Ann. Bot. Fenn., 29(2): 133. (Fig. 5.)
– *Ranunculus auricomus* subsp. *atriviolascens* Markl. 1961. Fl. Fenn. 3: 27.

Most important morphological characters: Slim plant with toothless, linear cauline leaves



Figure 5. *Ranunculus atriviolascens* (Markl.) Ericss.



Figure 6. *Ranunculus basitruncatus* Borch.-Kolb.

and small most developed basal leaves with angle 120–180° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, lateral and main segments sessile without well-developed petioles. Lower part of basal leaves, leaf stalks and main stem often with well-expressed purplish color. Flowers with fully or nearly fully reduced petals.

Distribution and ecology in Latvia: Occurs relatively rare and scattered in different types of grasslands – in pastures, wet grasslands, ruderal places and ditches.

***Ranunculus basitruncatus* Borch. - Kolb 1985.** Mitt. Bot. Staatssamml. München, 21(1): 141. (Fig. 6.)

Most important morphological characters: Medium-sized (slim) plant with linear toothless cauline leaves. Most developed basal cycle leaves medium-sized with very wide angle 140–180° of leaf base, with different leafblades - undivided and 3-lobed leaf blades with unlobed

and non-overlapped lateral segments. Flowers with nearly of fully reduced petals.

Distribution and ecology in Latvia: Occurs rare and unequally – mainly in eastern and central part of Latvia. There are only four places known from Zemgale and Kurzeme – Otaņķi, Ukri, in valley of river Abava near Kandava and Venta valley near Kuldīga. Grows mainly in different grasslands (Nītaure, Koknese, Tilža, Sitas-Pededzes floodland), parks (Aldara park in Rīga, Alūksne) and wet alluvial forests – Šķeltova, Dundursils in Gauja national park, Barkava oak forest and other.

***Ranunculus brunnescens* (Markl.) Ericss. 1992.** Ann. Bot. Fenn., 29(2): 135. (Fig. 7.)
– *Ranunculus auricomus* subsp. *brunnescens* Markl. 1961. Fl. Fenn. 3: 32.

Most important morphological characters: Medium-sized (slim) plant with linear, toothless cauline leaves and small to medium-sized most developed basal leaves with angle 50–80° of leaf base. Basal cycle leaves with no leaves

with whole or trilobated leaf blade with whole lateral segments – all basal leaves with 3-lobed leaf blade with lobed lateral segments, on biggest basal leaves secondary lobes of lateral segments regular, palmiform (*folia palmatifida*). Lateral and main segments sessile without well-developed petioles. Flowers with fully or nearly fully reduced petals.

Distribution and ecology in Latvia: Relatively rare in the whole territory of Latvia. Grows mostly in different types of meadows (pastures, alluvial, even ruderal), different forest types – from deciduous oak forests to black alder swamp forests, as well as young aspen stands, old manor parks and other anthropogenic habitats.

***Ranunculus euryphyllarius* (Markl.) Ericss.** 1992. Ann. Bot. Fenn., 29(2): 138. (Fig. 8.)
– *Ranunculus auricomus* subsp. *euryphyllarius* Markl. 1961. Fl. Fenn. 3: 49.

Most important morphological characters: Robust plant with oblanceolate, irregularly

toothed (2–5 long teeth) cauline leaves. Most developed basal cycle leaves medium-sized to robust with angle 30–90° of leaf base, with 3-lobed leaf blade with wide, partially overlapped and deeply lobed median segment and lateral segments. Flowers with partially or completely reduced petals. The most common species of this group with toothed cauline leaves in Latvia.

Distribution and ecology in Latvia: Occurs relatively rare and equally in the whole territory of Latvia. Different contact zones and strips are very characteristic of this species – roadsides, forest sides, shrub strips along roads, alleys, ditches and other similar places. In manor parks (Cēre, Dundaga, Eleja, Koknese, Vecauce). Some localities are known from old manor parks (Lielplatone, Sasmaka, Smiltene, Vilce and Cirsti) as well as alluvial meadows and forests.

***Ranunculus glaucescens* (Markl.) Ericss.** 1992. Ann. Bot. Fenn., 29(2): 140. (Fig. 9.)
– *Ranunculus auricomus* subsp. *glaucescens* Markl. 1961. Fl. Fenn. 3: 52.



Figure 7. *Ranunculus brunnescens* (Markl.) Ericss.



Figure 8. *Ranunculus euryphyllarius* (Markl.) Ericss.



Figure 9. *Ranunculus glaucescens* (Markl.) Ericss.



Figure 10. *Ranunculus gyratidens* (Markl.) Ericss.

Most important morphological characters:

Medium-sized (slim) plant with oblanceolate, toothless, linear cauline leaves and small to medium-sized most developed basal leaves with angle 30–120° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade, some with lobed lateral segments. From similar *R. acutiusculus* and *R. atriviolascens* differs by well-developed petioles of main and lateral segments of basal leaves as well as glaucous color of whole plant. Flowers with partially developed petals.

Distribution and ecology in Latvia:

Occurs relatively rare and unequally – mainly in eastern and central part Latvia – Vidzeme and Latgale. Grows mostly in old manor parks, as well as different grassland habitats (pastures, alluvial grasslands), and species-rich natural pastures as well as different border strips – ditches and roadsides.

Ranunculus gyratidens (Markl.) Ericss. 1992. Ann. Bot. Fenn., 29(2): 141. (Fig. 10.)

– *Ranunculus auricomus* subsp. *gyratidens* Markl. 1961. Fl. Fenn. 3: 59.

Most important morphological characters:

Medium-sized (slim) plant with linear, toothless cauline leaves and small to medium-sized most developed basal leaves with angle 20–80° of leaf base. Basal cycle leaves with no leaves with whole or trilobated leaf blade with whole lateral segments – all basal leaves with 3-lobed leaf blade with lobed lateral segments. Species resembling small plants of *R. brunnescens*, but differs by irregular secondary lobes of lateral segments on biggest basal leaves, leaf blade not palmiform. Lateral and main segments sessile without well-developed petioles. Flowers with fully or nearly fully reduced petals.

Distribution and ecology in Latvia:

Occurs relatively rare and scattered in the whole territory of Latvia. Characteristic mostly for different grassland habitats, but prefer wet places or even floodlands, as well as wet forest habitats – meliorated forests on turf soils, alluvial forests and shrublands.

***Ranunculus integerrimus* (Julin) Borch. – Kolb 1985. Mitt. Bot. Staatssamml. München, 21(1): 145. (Fig. 11.)**

Most important morphological characters:

Medium-sized (slim) plant with linear toothless cauline leaves. Most developed basal cycle leaves medium-sized with very wide angle 120–160° of leaf base, with different leaf blades – undivided leaves (smaller as divided leaves) and biggest leaves in cycle dissected, with 5-lobed leaf blades. Flowers with nearly of fully developed petals.

Distribution and ecology in Latvia: Occurs very rare and scattered the whole territory of Latvia, only in some parks and greeneries – Aizpute, Piltene. Species is known from natural forest habitats – oak forest in Barkava and Porečje near Dagda in alluvial meadow. In order to discuss about characteristic habitats and distribution in region, additional research on the distribution and additional herbaria material in Latvia are needed.

***Ranunculus linkolae* (Markl.) Ericcs. 1992. Svensk Bot. Tidskr. 86(2): 80. (Fig. 12.) – *Ranunculus auricomus* subsp. *linkolae* Markl. 1961. Fl. Fenn. 3: 74.**

Most important morphological characters:

Medium –sized (slim) plant with linear or oblanceolate, toothless cauline leaves and small to medium-sized most developed basal leaves with angle 120–150° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, at least one leaf blade with whole, divided but not lobated lateral segments. Flowers with fully or nearly fully developed petals. From similar *R. acutiusculus*, *R. gyratidens* or *R. brunnescens* differs by well-developed petals.

Distribution and ecology in Latvia: Occurs very rare only in one points of Latvia: species is known from natural forest habitats – oak forest Dundursils near Priekule. As the species



Figure 11. *Ranunculus integerrimus* (Julin) Borch. – Kolb.



Figure 12. *Ranunculus linkolae* (Markl.) Ericcs.



Figure 13. *Ranunculus macrophyllarius* (Markl.) Ericcs.



Figure 14. *Ranunculus marklundii* (Julin & Nannf.) Ericcs.

is very rare in Latvia, we cannot discuss about characteristic habitats and distribution in region, additional research on the distribution and additional herbaria material in Latvia are needed.

***Ranunculus macrophyllarius* (Markl.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 144. (Fig. 13.) – *Ranunculus auricomus* subsp. *Macrophyllarius* Markl. 1961. Fl. Fenn. 3: 77.

Most important morphological characters: Slim or robust plant with linear, mostly irregularly toothed (0–2 long teeth) cauline leaves. Most developed basal cycle leaves medium-sized with angle 80–130° of leaf base, with 3-lobed leaf blade, where lateral lobes divided or even dissected with no wide, overlapped lobes, therefore leaves looks round and resembling leaves of *R. acris* from which differs from other similar species of this group – *R. euryphyllarius*. All flowers with reduced petals.

Distribution and ecology in Latvia: Occurs very rare in the whole territory of Latvia. Grows

in mostly in old manor parks, less common in different wet, alluvial forest habitats and different contact zones – roadsides and ditches (Elkšņi, Silene).

***Ranunculus marklundii* (Julin & Nannf.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 145. (Fig. 14.) – *Ranunculus auricomus* subsp. *Marklundii* Nannf. & Julin, 1965. Ark. Bot., ser. 2, 6: 62.

Most important morphological characters: Medium-sized (slim) plant with linear, sessile cauline leaves with whole margin or sometimes with 1–2 big lobes. Most developed basal cycle leaves small to medium-sized with angle 50–110° of leaf base, at least 1-3 largest leaves with whole leaf blade, but some leaves with 3-5 lobed or dissected leaf blade with whole or deeply lobed lateral segments. Flowers with partially or fully developed petals.

Distribution and ecology in Latvia: In Latvia occurs rare and unequal, mostly from western part – in manor parks (Dundaga, Laidi, Snēpele)

as well as in arboretum Lāčupīte and only one natural habitat – calcareous *Molinia* grassland in nature protected territory “Čūžu purvs”.

***Ranunculus obtusidents* (Julin) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 147. (Fig. 15.)

– *Ranunculus auricomus* subsp. *obtusidents* Julin, 1967. Ark. Bot., ser. 2, 6: 287.

Most important morphological characters:

Medium-sized (slim) plant with linear, sessile cauline leaves with whole margin or sometimes with 0–1 long teeth or even lobes on each side. Most developed basal cycle leaves small to medium-sized with narrow angle 40–80° of leaf base. Basal cycle leaves mostly deeply trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade, with wide, whole lateral segments, sometimes overlapped with wide median segment. Flowers with partially or fully developed petals. Receptacle sparsely hairy.

Distribution and ecology in Latvia: Occurs very rare, known from only one locality in south

– eastern part in Latvia – in Baltinava old manor park, where several samples were re-collected during last years.

***Ranunculus obtusulus* Markl.** 1940. Memoranda Soc. Fauna Fl. Fenn. 16: 49. (Fig. 16.)

Most important morphological characters:

Medium-sized (slim) plant with oblanceolate or linear sessile cauline leaves with whole margin. Most developed basal cycle leaves small to medium-sized with angle 70–150° of leaf base. All leaves in cycle typically round-shaped, with rounded leaf lobes. Largest leaves with 3-lobed leaf blade with wide, non-overlapped with lobed or cleft (but not dissected) lateral segments, all segments with rounded leaf lobes. Some leaves of basal cycle can be with whole leaf blade. Flowers with nearly of fully developed petals.

Distribution and ecology in Latvia: Relatively rare in the whole territory of Latvia. Grows in mostly in different types of meadows (pastures, alluvial meadows, even lawns), different forest types – from deciduous oak forests to nemoral



Figure 15. *Ranunculus obtusidents* (Julin) Ericcs.



Figure 16. *Ranunculus obtusulus* Markl.



Figure 17. *Ranunculus oligandrus* (Markl.) Ericcs.



Figure 18. *Ranunculus orbicans* (Markl.) Ericcs.

aspen forests on mineral soils, as well old manor parks and other anthropogenic habitats.

***Ranunculus oligandrus* (Markl.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 147. (Fig. 17.)
– *Ranunculus auricomus* subsp. *oligandrus* Markl. 1961. Fl. Fenn. 3: 88.

Most important morphological characters: Medium-sized (slim) plant with long, linear, toothless cauline leaves and small to medium-sized most developed basal leaves with angle 90–120° of leaf base. Basal cycle leaves with no leaves with whole or trilobated leaf blade with whole lateral segments – all basal leaves with 3-lobed leaf blade with deeply dissected lateral segments. Flowers with fully or nearly fully developed petals. Species resembling *R. brunnescens*, but differs by irregular secondary lobes of lateral segments on biggest basal leaves, and by well-developed corollas.

Distribution and ecology in Latvia: Relatively rare in the whole territory of Latvia, mostly from old manor parks (Lūznava, Upesmuiža,

Ilgas, Eleja, Kazdanga), arboretum Silva. Characteristic habitats for this species is also different wet grasslands and even calcareous fens – nature protected territories, for instance – Dviete floodland and Čūžu purvs.

***Ranunculus orbicans* (Markl.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 147. (Fig. 18.)
– *Ranunculus auricomus* subsp. *orbicans* Markl. 1961. Fl. Fenn. 3: 93.

Most important morphological characters: Medium-sized (slim) plant with linear, sessile cauline leaves with 2–5 long symmetric teeth, only some leaves toothless. Most developed basal cycle leaves small to medium-sized with narrow angle 0–60° of leaf base with 3-lobed leaf blade, where lateral lobes divided or even dissected, therefore leaves looks round and resembling leaves of *R. acris*. Species differs from other similar species of this group (*R. euryphyllarius*, *R. macrophyllarius*) by wide, deeply lobated and overlapped median segment of basal leaves, rounded leaf shape of basal leaves with very narrow angle of leaf base and

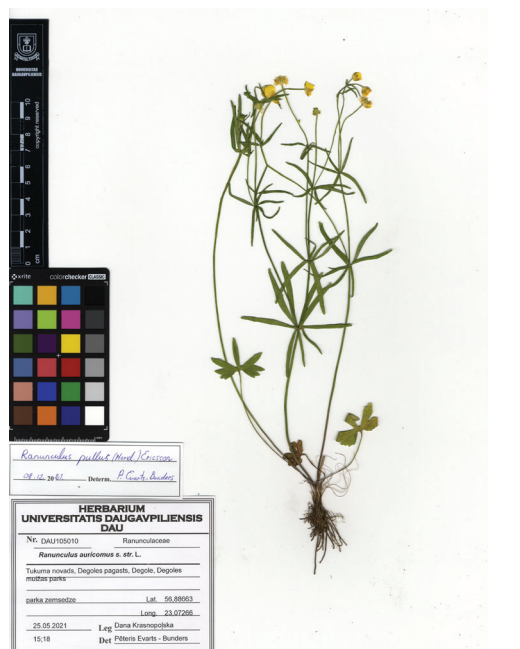


Figure 19. *Ranunculus pullus* (Markl.) Ericcs.



Figure 20. *Ranunculus stenodon* (Markl.) Ericcs.

typically long, narrow teeth of cauline leaf. All flowers with partially or fully reduced petals.

Distribution and ecology in Latvia: Occurs very rare in Latvia, only in some parks and greeneries in Kapsēde, Stukmaņi, Cirsti, and not known from natural habitats. Additional research on the distribution and additional herbaria material in Latvia are needed to discuss about species status and trends of distribution here.

***Ranunculus pullus* (Markl.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 150. (Fig. 19.)
– *Ranunculus auricomus* subsp. *pullus* Markl. 1961. Fl. Fenn. 3: 102.

Most important morphological characters: Medium-sized (slim) plant with linear, toothless cauline leaves and small to medium-sized most developed basal leaves with angle 110–170° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, lateral and main segments sessile without well-

developed petioles. At least one biggest leaf of basal leaf cycle with dissected or dissected lateral segments and linear, narrow, toothless median segment – most different from the other similar species in this group (*R. acutiusculus*, *R. gyatidens*, *R. atriviolascens*). Flowers with partially developed petals. Receptacle densely hairy.

Distribution and ecology in Latvia: Relatively rare in the whole territory of Latvia, mostly less common in different contact zones – roadsides, ditches and grasslands.

***Ranunculus stenodon* (Markl.) Ericcs.** 1992. Ann. Bot. Fenn., 29(2): 152. (Fig. 20.)
– *Ranunculus auricomus* subsp. *stenodon* Markl. 1961. Fl. Fenn. 3: 112.

Most important morphological characters: Medium-sized (slim) plant with linear, sessile cauline leaves with 1–3 long aristate (awn-like) teeth. Most developed basal cycle leaves small to medium-sized with wide angle 120–160° of leaf base. Basal cycle leaves mostly trilobated with no leaves with whole leaf blade. Most

developed, biggest leaves with 3-lobed leaf blade with lobed or cleft, but not dissected lateral segments. Median segment relatively wide and with tooth. Flowers with partially developed petals. Receptacle densely hairy.

Species differs from other similar species of this group (*R. euryphyllarius*, *R. macrophyllarius*, *R. pullus*) by trilobated basal leaves with only lobated, but not divided or dissected lateral segments of most developed basal leaves.

Distribution and ecology in Latvia: Occurs very rare only in one point of Latvia: species is collected several times from anthropogenic grassland in Skujenes parish. As the species is very rare in Latvia, we cannot discuss about characteristic habitats and distribution in region. Additional research on the distribution and additional herbaria material in Latvia are needed.

DISCUSSION

The native range of *R. auricomus* L. s. l. covers Northern and Central Europe, European part of Russia (Fig. 21.) and further in Western Asia. Large number of microspecies described in Eastern Europe, show a low morphological differentiation (Ericsson 1992, Dunkel et al. 2018, Jalas & Suominen 1989) with a very large number of endemic species in countries and regions. For instance – 205 species are recognized in Finland (Kurtto et al. 2019), 58 in flora of Great Britain and Ireland (Leslie 2018), 17 – in Spain (Dunkel 2021) but, at the same time, only one (*R. pindicola*) in Greece (Dunkel 2015), and it is clear, that species diversity in *R. auricomus* group is declining to the south. Comparing the species diversity of *R. auricomus* group with hairy receptacles in European part of Russia, species of this group are separated and even described as new endemic taxa in some regions or in whole territory of European Russia. So, 18 species mentioned for the whole Western part of Russia, some of them as groups of complex species (Tzvelev 2001, 2012), and, for example, for Pskov region of Russia which

bordering Latvia – 5 (Efimov & Konechnaya 2018).

As a result of unclear morphological boundaries between the main four groups, (*Ranunculus auricomus*, *R. cassubicus*, *R. fallax* and *R. monophyllus* Ovcz.) four species concept (Marklund 1961, 1965, Ericsson 1992), has not been used in Central Europe (e.g. Hörandl & Gutermann 1998a; Dunkel 2010, Dunkel et al. 2018). In our work we, however, agree with this concept and use these informal groups for dividing species of *R. auricomus* complex (Evarts-Bunders et al. 2021). Knowing the ‘crossroad’ status of Latvian flora in the Eastern European flora context, a relatively high number of *R. auricomus* complex species was predictable. In this research 18 species on *R. auricomus* complex species with sparsely to densely hairy receptacle – approximately one half from whole number of *R. auricomus* group species in Latvia are given. Even if the number of species will change in future after more detailed research, it is clear, that this group is richly represented in Latvia.

Relating to the chorological and distributional aspects of the species of *R. auricomus* group in Latvia, convincingly largest part – 14 (*R. acutiusculus*, *R. amblyodon*, *R. atriviolasces*, *R. brunnescens*, *R. euryphyllariusi*, *R. glaucescens*, *R. gyratidens*, *R. linkolae*, *R. macriphyllarius*, *R. obtusulus*, *R. oligandrus*, *R. orbicans*, *R. pullus*, and *R. stenodon* are taxa, described by G. Marklund from the Southern part of Finland (1965), another three species – *R. integerrimus*, *R. marklundii* and *R. obtusidens*, described by E. Julin (1965, 1966, 1980) from the Southern part of Sweden and later found in Baltic Sea islands – Öland and Gotland. Only one species of this group is described from Central Europe – *R. basitruncatus* by German botanist E. Borchers-Kolb. Notably, that there are only two species of this group in Latvia with a relatively wide distribution area – in Central Europe, Scandinavia and Eastern Europe – *R. basitruncatus* and *R. obtusidens*. (Tzvelev 2001, Jalas & Suominen 1989). Particularly wide distribution area is known for *R. basitruncatus* which is known

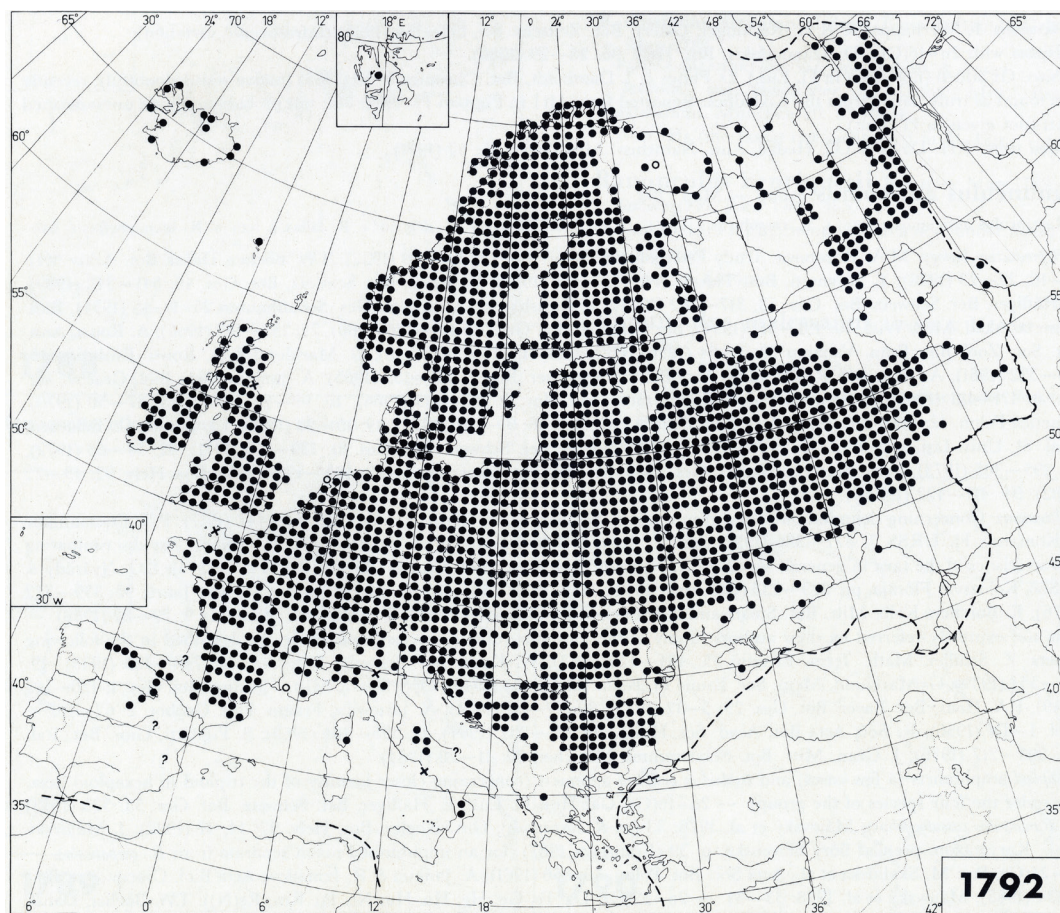


Figure 21. Distribution of *R. auricomus* group in Europe (Jalas & Suominen 1989).

even from Perm region (Chugainova 1997). Narrow ranges and very local distribution of apomictic *R. auricomus* complex species are widely recognized in Europe, even in the last years (e.g. Dunkel 2019, 2021). A good example is a new flora of the British Isles and Ireland, where all complex (58 species of *R. auricomus* complex) is only endemic, British-origin species with no taxa with wide, continental area (Leslie 2018).

It is too early to discuss about the ways and patterns of distribution and entry routes as well as predict the appearance of new *R. auricomus* complex species in Latvia. At the same time – it is very possible, that after more detailed further studies both – new species, known from neighbouring countries, as well as completely

new, neoendemic taxa of apomictic *R. auricomus* group can be found in this floristically rich and peculiar region.

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SUPPLEMENT

Table 1. Comparison of diagnostic characters for the species of the *Ranunculus auricomus* group with hairy receptacles in the Latvia.

	Flowering shoot	Lower stem leaves	Lower stem	Basal leaves	Basal lobes	Pertanth	Receptacle (Gynochium)
<i>Ranunculus acutiusculus</i>	Slim, (29-) 32-42 (-45) cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, lateral and main segments sessile without well-developed petioles.	3.5-6.5 (8) cm, all basal leaves narrow or wide angle (60°-120°)	Partially or fully reduced	Sparsely hairy
<i>Ranunculus amblyodon</i>	Slim, (16-) 22-30 (-35) cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, only most developed basal cycle leaves with fully dissected main segments lateral and main segments sessile.	3-5 (6) cm, all basal leaves narrow (20°-80°)	Well developed	Hairy
<i>Ranunculus ativolascens</i>	Slim, (16-) 18-25 (-28) cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, lateral and main segments sessile. Lower part of basal leaves, leaf stalks and main stem often with well-expressed purplish color.	2.5-4.5 (5) cm, all basal leaves with wide angled base (120°-180°)	Partially or fully reduced	Hairy
<i>Ranunculus basitruncatus</i>	Slim, 30-40 (-45) cm	Linear	Without teeth	Different leafblades - undivided and 3-lobed leaf blades with unlobed and non-overlapped lateral segments.	4.5-6 (7) cm, all basal leaves with wide angled base (140°-180°)	Fully reduced	Hairy
<i>Ranunculus brunnescens</i>	Slim, (25-) 28-38 (50) cm	Linear	Without teeth	Basal cycle leaves with no leaves with whole or trilobated leaf blade with whole lateral segments – all basal leaves with 3-lobed leaf blade with lobed lateral segments. On biggest basal leaves secondary lobes of lateral segments regular, palmiform. Lateral and main segments sessile without well-developed petioles.	3-6 cm, all basal leaves with narrow angled base (40°-90°)	Partially or fully reduced	Hairy

	Flowering shoot	Lower stem leaves	Lower stem leaf tooth	Basal leaves	Basal lobes	Pertanth	Receptacle (Gynochium)
<i>Ranunculus eurythylarius</i>	Robust, (30-) 41-60 cm	Lanceolate	With 2-5, long irregular teeth on each side	With 3-lobed leaf blade with wide, partially overlapped and deeply lobed median segment and lateral segments.	5-7 (8) cm, all basal leaves with narrow angled base (30°-90°)	Partially or fully reduced	Hairy
<i>Ranunculus glaucescens</i>	Slim, 30-40 (-45) cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade - most developed leaves with 3-lobed leaf blade, some with lobed lateral segments.	4-6 (7) cm, all basal leaves narrow or wide angle (30°-120°)	Partially developed	Hairy
<i>Ranunculus gyraudens</i>	Slim, (25-) 3-40 (-48) cm	Linear	Without teeth	Basal cycle leaves with no leaves with whole or trilobated leaf blade with whole lateral segments - all basal leaves with 3-lobed leaf blade with lobed lateral segments. Species resembling small plants of <i>R. brumescens</i> , but differs by irregular secondary lobes of lateral segments on biggest basal leaves, leaf blade not palmiform. Lateral and main segments sessile without well-developed petioles.	3-5 cm, all basal leaves with narrow angled base (25°-80°)	Fully reduced	Sparsely hairy
<i>Ranunculus integerrimus</i>	Slim, 33-42 (-45) cm	Linear	Without teeth	With different leaf blades - undivided leaves (smaller as divided leaves) and biggest leaves in cycle dissected, with 5-lobed leaf blades	3.5-5.5 cm, all basal leaves with wide angled base (110°-160°)	Mostly well developed	Hairy
<i>Ranunculus linkolae</i>	Slim, 28-40 cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade - most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, at least one leaf blade with whole, divided but not lobated lateral segments.	2.5-4 cm, all basal leaves with wide angled base (120°-150°)	Well developed	Sparsely hairy

	Flowering shoot	Lower stem leaves	Lower stem leaf tooth	Basal leaves	Basal lobes	Pertanth	Receptacle (Gynoclinium)
<i>Ranunculus macrophyllarius</i>	Robust, (3.5–) 40–50 cm	Linear, long	With 0–2, long teeth on each side	With 3-lobed leaf blade, where lateral lobes divided or even dissected with no wide, overlapped lobes, therefore leaves looks round and resembling leaves of <i>R. acris</i> from which differs from other similar species of this group – <i>R. euryphyllarius</i> .	5–7 cm, all basal leaves narrow or wide angle (80°–140°)	Partially or fully reduced	Hairy
<i>Ranunculus marktandii</i>	Slim, 25–40 cm	Linear	Without teeth or rarely lobes	At least 1–3 largest leaves with whole leaf blade, but some leaves with 3–5 lobed or dissected leaf blade with whole or deeply lobed lateral segments.	3–6 cm, all basal leaves narrow or wide angle (50°–110°)	Partially developed or well developed, rarely fully reduced	Sparsely hairy
<i>Ranunculus obtusidens</i>	Slim, 25–42 cm	Linear	With 0–1, long teeth or even lobes on each side	Basal cycle leaves mostly deeply trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade, with wide, whole lateral segments, sometimes overlapped with wide median segment.	3–5 cm, all basal leaves narrow or wide angle (40°–80°)	Partially or fully developed.	Sparsely hairy
<i>Ranunculus obtusulus</i>	Slim, 21–40 cm	Lanceolate	Without teeth	All leaves in cycle typically round-shaped, with rounded leaf lobes. Largest leaves with 3-lobed leaf blade with wide, non-overlapped with lobed or cleft (but not dissected) lateral segments, all segments with rounded leaf lobes. Some leaves of basal cycle can be with whole leaf blade.	2.5–4.5 (6) cm, all basal leaves narrow or wide angle (70°–150°)	Partially developed	Sparsely hairy
<i>Ranunculus oligandrus</i>	Slim, 28–45 cm	Linear, long	Without teeth	All leaves in cycle typically round-shaped, with rounded leaf lobes. Largest leaves with 3-lobed leaf blade with wide, non-overlapped with lobed or cleft (but not dissected) lateral segments, all segments with rounded leaf lobes. Some leaves of basal cycle can be with whole leaf blade.	3.5–5 cm, all basal leaves wide angle (90°–120°)	Well developed	Sparsely hairy

	Flowering shoot	Lower stem leaves	Lower stem	Leaf tooth	Basal leaves	Basal lobes	Pertanth	Receptacle (Gynochium)
<i>Ranunculus orbicans</i>	Slim, 25–35 cm	Linear	With 2–5, long irregular teeth on each side	With 3-lobed leaf blade, where lateral lobes divided or even dissected, therefore leaves looks round and resembling leaves of <i>R. acris</i> . Species differs from other similar species of this group (<i>R. eurphyllarius</i> , <i>R. macrophyllarius</i>) by wide, deeply lobated and overlapped median segment of basal leaves, rounded leaf shape of basal leaves with very narrow angle of leaf base and typically long, narrow teeth of cauline leaf.	3.5–4.5 cm, all basal leaves with narrow angled base (0°–60°)	Partially or fully reduced	Hairy	
<i>Ranunculus pululus</i>	Slim, 25–36 cm	Linear	Without teeth	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade – most developed leaves with 3-lobed leaf blade with lobed lateral segments, but, at same time, lateral and main segments sessile without well-developed petioles. At least one biggest leaf of basal leaf cycle with dissected or dissected lateral segments and linear, narrow, toothless median segment.	3–5 cm, all basal leaves wide angle (110°–170°)	Partially developed	Densely hairy	
<i>Ranunculus stenodon</i>	Slim, 28–36 cm	Lanceolate	With 1–3, long teeth on each side	Basal cycle leaves mostly trilobated with no leaves with whole leaf blade. Most developed, biggest leaves with 3-lobed leaf blade with lobed or cleft, but not dissected lateral segments. Median segment relatively wide and with tooth.	4–5 cm, all basal leaves wide angle (120°–160°)	Partially developed	Densely hairy	