

Is *Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey. (Caryophyllaceae: Alsinoideae) just a subtaxon of *H. umbellatum* L. or a distinct species?

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Summary. The genus *Holosteum* L. distributed mostly in temperate Eurasia has very confused taxonomy. Modern estimation of the species richness varies from one species worldwide to seven species occurring just in Eastern Europe. One of the most problematic species of the genus is *H. glutinosum* (M. Bieb.) Fisch. et C. A. Mey. usually treated as a subspecies or a variety of *H. umbellatum* L. On the base of extensive study of the protologues, type material, a rich variety of other herbarium specimens, photos of all relevant taxa, and living plants in the field we recognize *H. glutinosum* as a distinct species. This species has three characters unique in the genus *Holosteum*: pure green color of leaves and sepals, completely herbaceous bracts, and lanceolate leaves; additional diagnostic characters are 10 stamens, dense glandular pilosity of leaves, sepals, bracts, stem, and pedicels, and entire petals longer than sepals. The species also has statistically significant differences from *H. umbellatum* (longer leaves, longer and wider petals, and longer capsule) while occurring in sympatry with it. Two subspecies are recognized within *H. glutinosum*: *H. glutinosum* subsp. *glutinosum* distributed in Caspian Depression, Transcaucasia, Western and Middle Asia, and *H. glutinosum* subsp. *liniflorum* Fateryga, nom. et stat. nov. (\equiv *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837], nom. illeg.), presumably endemic to the Crimea. The lectotypes are designated for the latter name and also for *H. glandulosum* Bertol., *H. umbellatum* var. *pleiandrum* Fenzl, *H. imberbe* J. Gay, nom. illeg. superfl., *H. imberbe* var. *brachypetalum* J. Gay, and *H. imberbe* var. *macropetalum* J. Gay. Reports of *H. glutinosum* from most European countries (other than Russia) are considered to be erroneous due to numerous misidentifications in herbaria and incorrect synonymy (e. g., with *H. heuffelii* Wierzb., which is actually conspecific with *H. umbellatum*). A key to the species and subspecies is provided; a total of six taxa are recognized in the genus: *H. breistrofferi* Greuter et Charpin, *H. glutinosum* subsp. *glutinosum*, *H. glutinosum* subsp. *liniflorum*, *H. marginatum* C. A. Mey., *H. tenerrimum* Boiss., and *H. umbellatum*.

***Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey.
(Caryophyllaceae: Alsinoideae) – лишь субтаксон
H. umbellatum L. или самостоятельный вид?**

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Ключевые слова: лектотип, номенклатура, распространение, систематика, таксономия, типификация.

Аннотация. Род *Holosteum* L., распространенный преимущественно в умеренной зоне Евразии, характеризуется крайне запутанной таксономией. Современные оценки его видового богатства варьируют от всего одного вида в мире до семи видов только лишь в Восточной Европе. Одним из наиболее проблемных видов является *H. glutinosum* (M. Bieb.) Fisch. et C. A. Mey., который обычно рассматривают как подвид или разновидность *H. umbellatum* L. На основе изучения протоколов, типовых образцов, большого количества других гербарных материалов, фотографий всех релевантных таксонов и живых растений в природе установлено, что *H. glutinosum* является самостоятельным видом. Данный вид обладает тремя признаками, уникальными в роде *Holosteum*: чисто-зеленый цвет листьев и чашелистиков, полностью травянистые листочки обертки соцветия и ланцетные листья. Дополнительными диагностическими признаками являются 10 тычинок, густое железистое опушение листьев, чашелистиков, листочков обертки соцветия, стебля и цветоножек, а также цельные лепестки, превышающие по длине чашелистики. Вид обладает статистически значимыми отличиями от *H. umbellatum* (более длинные листья, более длинные и широкие лепестки и более длинная коробочка) при совместном произрастании с последним. В составе *H. glutinosum* выделено два подвида: *H. glutinosum* subsp. *glutinosum*, распространенный в Прикаспийской низменности, Закавказье, Западной и Средней Азии, и *H. glutinosum* subsp. *liniflorum* Fateryga, nom. et stat. nov. (\equiv *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837], nom. illeg.), предположительно являющийся эндемиком Крыма. Для последнего названия, а также для *H. glandulosum* Bertol., *H. umbellatum* var. *pleiandrum* Fenzl, *H. imberbe* J. Gay, nom. illeg. superfl., *H. imberbe* var. *brachypetalum* J. Gay и *H. imberbe* var. *macropetalum* J. Gay обозначены лектотипы. Указания *H. glutinosum* для стран Европы (кроме России) предположительно являются ошибочными и основанными на многочисленных неверных определениях материала в гербариях и ошибочной синонимии (например, с *H. heuffelii* Wierzb., который в действительности конспецифичен *H. umbellatum*). Приводится ключ для определения видов и подвида рода; в общей сложности признается шесть таксонов: *H. breistrofferi* Greuter et Charpin, *H. glutinosum* subsp. *glutinosum*, *H. glutinosum* subsp. *liniflorum*, *H. marginatum* C. A. Mey., *H. tenerrimum* Boiss. и *H. umbellatum*.

Introduction

Holosteum L. (Caryophyllaceae: *Alsinoideae*) is a small genus of annual herbs native to temperate Eurasia (Hernández-Ledesma et al., 2015) and North Africa (Greuter et al., 1984) with the type species *H. umbellatum* L. that has additionally naturalized in the United States of America, Canada, Argentina, and the Republic of South Africa (Rabeler, Hartman, 2005). Although the genus is not species-rich, its taxonomy is very confused and requires a revision

(Fateryga et al., 2017). Modern estimations on the number of species in the genus vary. World Flora Online (2020) accepts the one species *H. umbellatum* with four subspecies: *H. umbellatum* subsp. *glutinosum* (M. Bieb.) Nyman, *H. umbellatum* subsp. *hirsutum* (Mutel) Breistr., *H. umbellatum* subsp. *viscosissimum* (Čelak.) Dvořák, and the type subspecies, while many other names in the genus *Holosteum* remain unresolved in this database. K. Marhold (2011) in Euro+Med PlantBase lists four species occurring in Europe and the Mediterranean

countries. Among them, *H. umbellatum* has five subspecies: those accepted in World Flora Online plus *H. umbellatum* subsp. *tenerrimum* (Boiss.) Greuter et Burdet. Three other species in Euro+Med PlantBase are *H. marginatum* C. A. Mey., which is a well recognized species (Fatoryga et al., 2017), *H. sperguloides* Lehm., which actually belongs to the genus *Spergularia* (Pers.) J. Presl et C. Presl (World Flora Online, 2020), and *H. subglutinosum* Klokov.

P. Hernández-Ledesma et al. (2015) reported the genus *Holosteum* to include three to four species worldwide without listing their names. A. V. Fatoryga et al. (2017) supposed that there were four species: *H. glutinosum* (M. Bieb.) Fisch. et C. A. Mey., *H. tenerrimum* Boiss., *H. umbellatum*, and *H. marginatum*. One of the most “splitting” estimations was provided by N. N. Tzvelev (2012) who recognized six species within the territory of Eastern Europe. Among them, there were *H. marginatum*, *H. glutinosum*, *H. umbellatum*, *H. klopotovii* (Tzvelev) Tzvelev, *H. syvaschicum* Kleopow, and *H. subglutinosum*; in our opinion, however, the latter three represent different pilosity variations of *H. umbellatum* and do not merit the rank of species or even subspecies.

Holosteum glutinosum is the most problematic taxon in the genus. It is usually treated as a subspecies of *H. umbellatum* (Atlas Florae ..., 1983; Walters, Akeroyd, 1993; Marhold, 2011; World Flora Online, 2020) or even as a variety *H. umbellatum* var. *glutinosum* (M. Bieb.) J. Gay (Coode, 1967; Zernov, Sokolov, 2004), although the latter name is superfluous (see below). On the other hand, some modern Russian authors (Lazkov, 2006, 2012; Tzvelev, 2012) continue to treat *H. glutinosum* as a full species as it was traditionally accepted in Soviet literature (Muravyeva, 1936; Grossheim, 1945; Czerepanov, 1995). It is generally considered that *H. (umbellatum* subsp./var.) *glutinosum* has 10 stamens and glandular pubescence developed on the whole green parts of the plant, while *H. umbellatum* (s. str.) has 3–5 stamens and bare bracts and/or lower parts of the stem/pedicels (Muravyeva, 1936; Grossheim, 1945; Schischkin, 1947; Coode, 1967; Walters, Akeroyd, 1993). Some authors also add that the first taxon has petals 1.5–2 times longer than sepals (Muravyeva, 1936; Schischkin, 1947; Lazkov, 2006) and capsule longer than 6.5 mm (Coode, 1967) while the second one has petals a little longer than sepals and capsule not longer than 6 mm.

A. S. Zernov and I. V. Sokolov (2004) considered that all diagnostic characters mentioned for both

H. glutinosum and *H. umbellatum* varied within their range from northwest to southeast showing a cline and making them to reduce *H. glutinosum* to the variety of *H. umbellatum*. On the other hand, N. N. Tzvelev (2004) reported that *H. glutinosum* had herbaceous bracts and narrow leaves while *H. umbellatum* had membranous bracts and broader leaves and G. A. Lazkov (2006) reported that *H. glutinosum* had entire petals while *H. umbellatum* had petals with dentate apical margin. These characters were overlooked by A. S. Zernov and I. V. Sokolov (2004), as well as by earlier European authors (Coode, 1967; Walters, Akeroyd, 1993). Such a confusion with the diagnostic characters of these two taxa led us to an assumption that some of the authors erroneously assigned the most pubescent plants of *H. umbellatum* s. str. to *H. (umbellatum* subsp./var.) *glutinosum* and such a mistake could be partial reason for reducing the latter species to a subtaxon of the former one.

At the same time, we found in 2013 a peculiar population of *H. glutinosum* in the Crimea, which occurred in the same habitat with *H. umbellatum* and showed remarkably distinct characters from the latter. These plants had characters corresponding to *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837], nom. illeg. (Fischer et al., 1840; see also Steven, 1856), which is currently treated as a synonym of *H. umbellatum* var. *glutinosum* (Zernov, Sokolov, 2004). Thus, the purpose of the present contribution is to ascertain the taxonomic status of *H. glutinosum*, as well as other taxa hitherto assigned to its synonyms, and to provide an identification key to all taxa known in the genus *Holosteum*.

Material and methods

Our study was based on traditional taxonomic methods. All protologues of the species of interest, as well as additional relevant references, were studied. The type material of most taxa and a large amount of additional specimens were examined in nine herbaria: CSAU, G (CHG, 2020), K (Kew Herbarium, 2020), KW, LE, MW (Seregin, 2020), P (MNHN, 2020), PHEO, and YALT, as well as in various digital herbaria via the Global Plants web-service (<https://plants.jstor.org/>). Photos of living plants were examined on the Plantarium web-site (Plantarium, 2007–2020) and on various other web-sites via the Google search (<https://www.google.com/>). We used the morphological method and examined the main important characters of *Holosteum* plants: leaf shape; leaf, bract, and sepal coloration; bract size and structure; petal size and

shape; capsule size; stem, pedicel, bract, and sepal pilosity. Distribution of the species was studied on the base of critically reviewed literature data, as well as the studied herbarium and photographic materials.

Living plants of *H. glutinosum* were studied in April 2016 in Zuya, Belogorsk District of the Republic of Crimea (45°03'39"N, 34°20'06"E), where they occurred in the same habitat with *H. umbellatum*. Thirty plants of each species were randomly selected and measured with a vernier caliper. The measured parameters were the shoot length, the upper leaf length and width, a petal length and width, and an opened capsule length. Then, the minimum, maximum, and mean values were calculated for each parameter. Confidence intervals of the mean values were calculated for 95 % confidence level ($p = 0.05$). Statistical significance of the differences between the mean values of two species was checked with Student's *t*-test (Lakin, 1990). PCA analysis of the same plants was made with Statistica 7 software.

To ascertain what taxonomic rank is to be applied to *H. glutinosum*, we assumed that a subspecies is a population (or several populations) of the species with morphological differences recognized by taxonomists (Mayr, 1974). This assumption means that two subspecies cannot co-occur in the same place. At the same time, the assumption does not mean that any morphological difference between allopatric populations is the reason to recognize one of them as a separate subspecies (many such differences are unstable and associated with ecological conditions).

Lectotype designation for *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837] was performed by Ari Taponen (University of Helsinki, Finland).

Results and discussion

What is *Holosteum glutinosum*?

Studying of all available materials has revealed that *H. glutinosum* is a well recognized species clearly distinct from four other well recognized species in the genus (see the key below) by three unique characters: pure green color of leaves and sepals, completely herbaceous bracts, and lanceolate leaves. These differences, however, are generally overlooked by most authors except N. N. Tzvelev (2004). Four other species have leaves with glaucous tincture, bracts either with membranous margins or nearly/almost completely membranous, and ovate leaves. Additional diagnostic characters of *H. glutinosum*, which are

not unique, are 10 stamens, dense glandular pilosity of leaves, sepals, bracts, stem, and pedicels, and entire petals longer than sepals.

Holosteum glutinosum is quite variable across its geographical range (Figs 1–2). The plants from the Volga Region, close to the type locality of the species (Fig. 1A), and the Middle Asia (Fig. 1B–D) usually have rather erect stem and relatively small petals. Plants from Asia Minor (Fig. 1E) and Transcaucasia (Fig. 1F–G) are rather ascending while their petals are also not very large. The most remarkable plants can be found in the Crimea where they always have erect, sometimes very tall stem and peculiarly large petals (Fig. 2A–F). All diagnostic characters of *H. glutinosum* listed above, however, are constant across its range.

The species has statistically significant differences from *H. umbellatum* when occurring in the same habitat with it. These differences are longer leaves, longer and wider petals, and longer capsule (Table). Samples of the two species studied in the Crimea also form two well recognized clouds in PCA analysis (Fig. 3). Thus, *H. glutinosum* cannot be treated as a subspecies or a variety of *H. umbellatum*. There is also a difference in phenology, which is well visible in Fig. 2B where these two species are shown together: *H. glutinosum* in flower and *H. umbellatum* in fruit. Another question, however, arises: is the name *H. glutinosum* correctly applied to the “green” species (i. e., the species with pure green color of leaves and sepals, completely herbaceous bracts, and lanceolate leaves)?

Holosteum glutinosum was originally described by F. A. Marschall von Bieberstein (1808: 344) as *Arenaria glutinosa* M. Bieb. The author did not specify the color of leaves and the structure of bracts (herbaceous or membranous) of his species. He, however, provided the data on the leaf shape: “foliis oblongis obtusiusculis” that corresponded rather to the “green” species. F. A. Marschall von Bieberstein (1808) also placed his description to the chapter “Decandria trigynia” that meant that the plant had 10 stamens, i. e., also corresponded to *H. glutinosum* in its current treatment (*H. umbellatum* has usually 5 stamens). Early authors, however, placed *A. glutinosa* to either synonyms or subtaxa of *H. umbellatum* (“glaucous” species). For example, E. Fenzl (1842) listed *H. glutinosum* among the synonyms of a glandularly pubescent variety *H. umbellatum* β [var.] *pleiandrum* Fenzl while obviously used another name *H. liniflorum* Steven ex Fisch. et C. A. Mey. for the “green” species (he, however, provided an incorrect reference to Fischer et al., 1838: 10, instead of Fischer et al., 1840: 52).

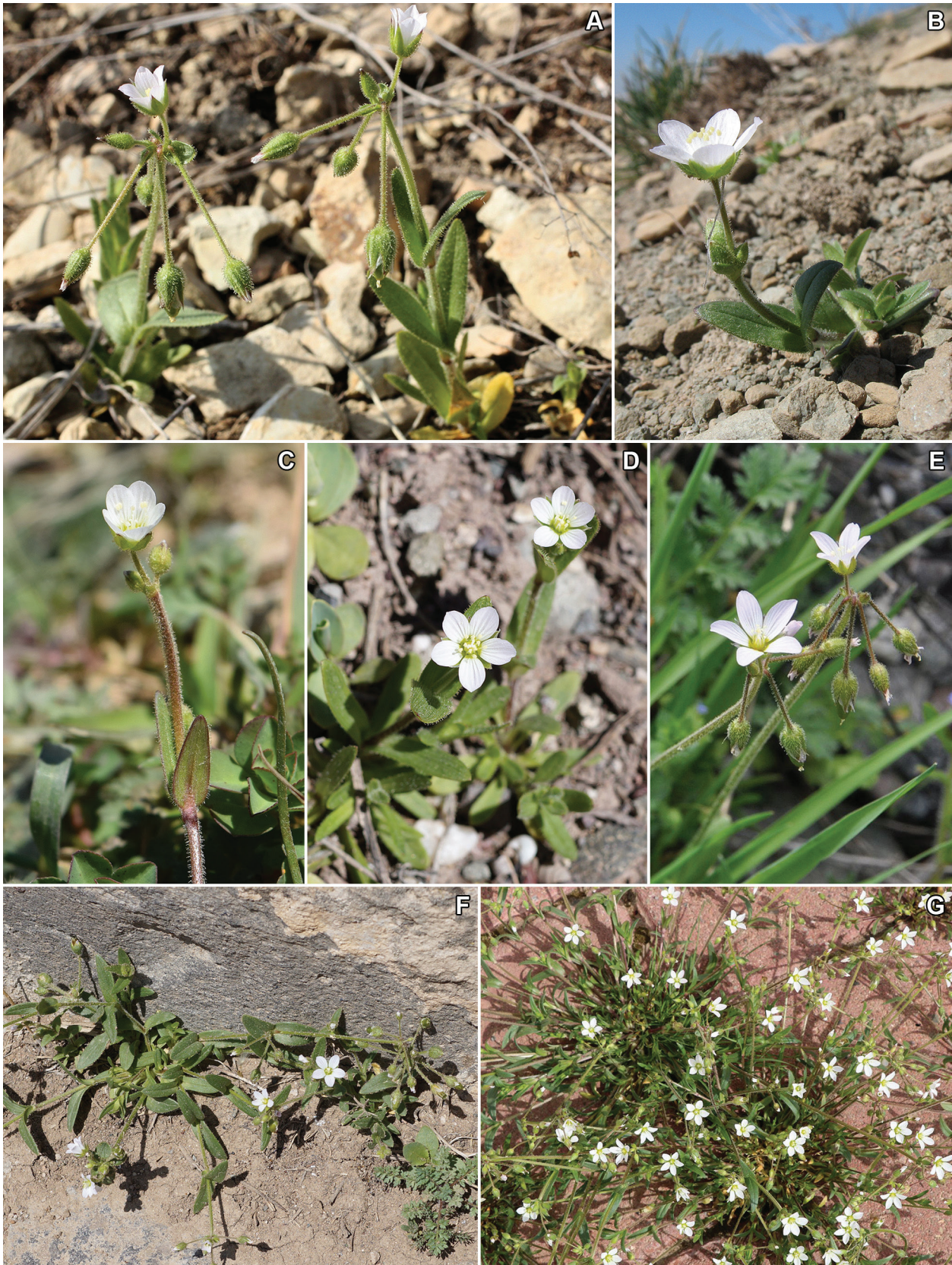


Fig. 1. *Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey. from various countries: A – Russia (Astrakhan Region); B – Kazakhstan (Jambyl Province); C – Uzbekistan (Tashkent); D – Kyrgyzstan (Chuy Province); E – Turkey (İğdir Province); F – Armenia (Yerevan); G – Azerbaijan (Nakhchivan Autonomous Republic). Photos by M. S. Knyazev (A), V. G. Kolbintsev (B), T. S. Tillaev (C), G. V. Chulanova (D and F), A. A. Lebedev (E), and N. K. Abbasov (G).

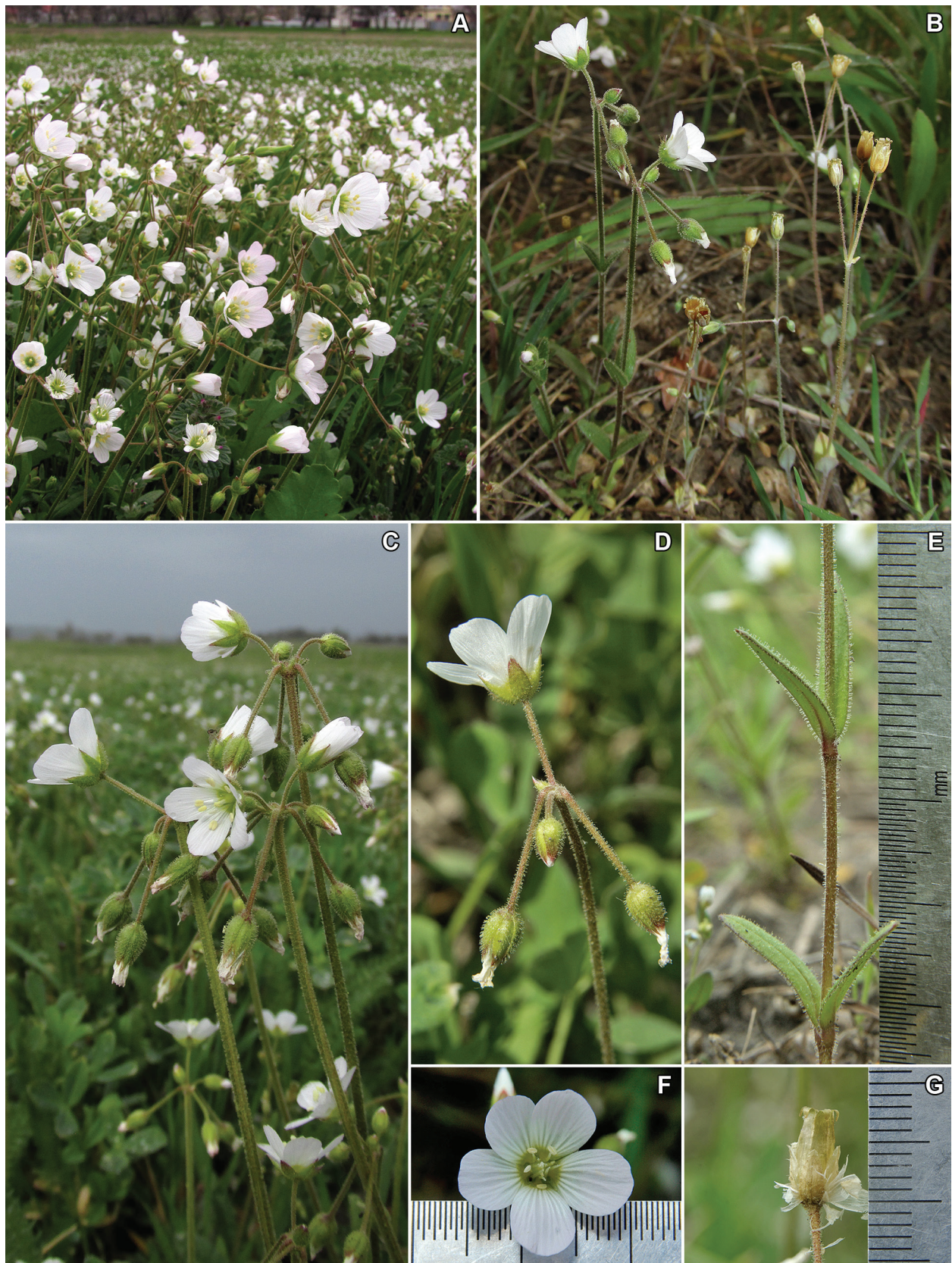
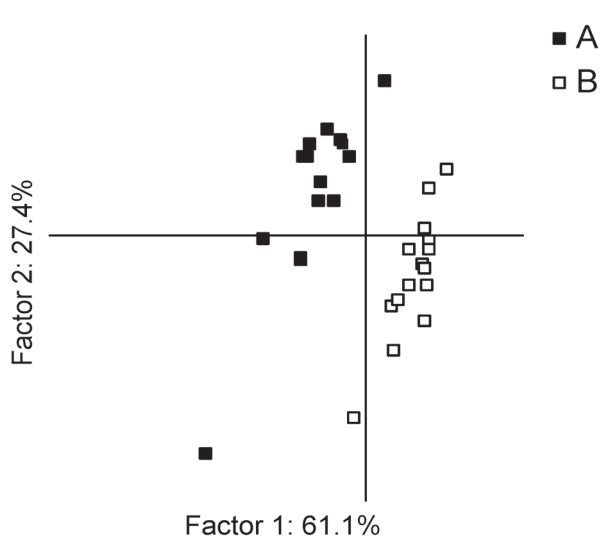


Fig. 2. *Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey. from the Crimea: A – habitat with flowering plants; B – flowering plant (on the left) together with fruiting plants of *H. umbellatum* L. (on the right); C – upper parts of flowering plants; D – inflorescence; E – part of a stem with two pairs of leaves; F – flower; G – opened capsule. Photos by P. E. Yevseyenkov (A), A. V. Fateryga (B and C), and S. A. Svirin (D–G).

Table
Morphometric parameters of the studied plants of *Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey.
and *H. umbellatum* L. from the same habitat in the Crimea

Parameter	n	<i>Holosteum glutinosum</i>		<i>Holosteum umbellatum</i>	
		min–max	$m \pm M$	min–max	$m \pm M$
Shoot length, cm	30	8.8–30.0	15.7 ± 1.7	4.3–19.5	12.0 ± 1.6
*Upper leaf length, mm	30	6.0–37.5	14.3 ± 2.0	5.0–12.4	8.1 ± 0.7
Upper leaf width, mm	30	0.5–7.2	2.6 ± 0.5	1.2–7.0	3.3 ± 0.5
*Petal length, mm	15	6.5–8.4	7.3 ± 0.3	3.0–3.5	3.3 ± 0.1
*Petal width, mm	15	3.3–5.1	4.1 ± 0.3	0.8–1.4	1.2 ± 0.1
*Opened capsule length, mm	15	6.3–10.3	7.9 ± 0.5	5.0–8.1	5.9 ± 0.4

Note: n – sample size, min – minimum value, max – maximum value, m – mean value, M – confidence interval ($p = 0.05$); parameters with statistically significant differences of values ($p \leq 0.01$) are marked with an asterisk.



■ A traits of various specimens (of both “glaucous” and “green” species).
□ B

Fig. 3. PCA analysis for plants of *Holosteum glutinosum* (M. Bieb.) Fisch. et C. A. Mey. (A) and *H. umbellatum* L. (B) from the same habitat in the Crimea.

J. Gay (1845: 27), while publishing the diagnosis of *H. umbellatum*, indicated that he assigned all “glaucous” plants to this taxon (“*H. glaucum*, <...> bracteis parvis membranaceis, <...>”) and treated *H. glutinosum* as a new variety *H. umbellatum* β [var.] *glutinosum*. The latter name, however, is nomenclaturally superfluous, since an earlier name at the same rank (*H. umbellatum* β [var.] *pleiandrum*) was cited as its synonym [Art. 52.1, 52.2(e), 52.4 of ICN (Turland et al., 2018)]. At the same time, J. Gay (1845: 37) created a new name for the “green” species (“*H. virens*, <...> bracteis parvis, herbaceis, <...>”), namely *H. imberbe* J. Gay, and included *H. liniflorum* in its synonyms. Both E. Fenzl (1842) and J. Gay (1845) stated that the number of stamens in *H. umbellatum* β [var.] *pleiandrum*/*glutinosum* was up to 10 (“6–10” and “7–10”, respectively). Thus, their varieties may probably represent an unsatisfactory mixture of the

traits of various specimens (of both “glaucous” and “green” species).

Soviet authors (Muravyeva, 1936; Grossheim, 1945; Schischkin, 1947; Czerepanov, 1995) were different in their taxonomic point of view on these two taxa. They clearly separated *H. glutinosum* (plants with 10 stamens) from *H. umbellatum* (plants with 3–5 stamens) but only N. N. Tzvelev (2004) completed their diagnoses with bract structure and leaf shape. The lectotype of *A. glutinosa* was designated by G. A. Lazkov and A. S. Zernov (see Zernov, Sokolov, 2004). The plants of the lectotype (Fig. 4) definitely represent the “green” species and clearly correspond to both the original description (Marschall von Bieberstein, 1808) and the modern Soviet/Russian treatment of *H. glutinosum*, although A. S. Zernov and I. V. Sokolov (2004) themselves did not accept it as a full species (see above).

As it was stated in the Introduction, modern taxonomic databases such as Euro+Med PlantBase (Marhold, 2011) or World Flora Online (2020) treat *H. glutinosum* as a subspecies of *H. umbellatum* that is not congruent with their co-occurring in sympatry (see above). One more possible reason of such an incorrect treatment, besides previous incorrect treatments by the early authors, is commonly occurring misidentifications of *H. umbellatum*, or sometimes also *H. tenerrimum* or even *H. marginatum*, as *H. glutinosum* in most European herbaria (with the exception of some Russian ones such as MW, see Seregin, 2020). For example, the plants on only one of nine sheets stored as *H. glutinosum* in P (MNHN, 2020) are correctly identified, namely a gathering from Armenia (P04975719). Among eight other sheets, six ones (P04975720, P04975802, P05020761–P05020763, and P05439558) represent typical *H. umbellatum* collected by Russian botanist A. K. Becker in Sarepta (currently Volgograd, Russia), close to the

type locality of *H. glutinosum*, in the second half of the XIX century (this case again confirms that the name *H. glutinosum* was commonly misapplied to *H. umbellatum* by earlier researchers). One more sheet (P04975801) also represents *H. umbellatum* but collected in Serbia where *H. glutinosum* seems not to be present (see below). Another sheet from Armenia (P04975721) is actually *H. marginatum*.

The third possible reason for the incorrect treatment of *H. glutinosum* as a subtaxon of *H. umbellatum* is incorrect synonymy. Thus, Euro+Med PlantBase (Marhold, 2011) and World Flora Online (2020) report *H. heuffelii* Wierzb. (\equiv *H. umbellatum* subsp. *heuffelii* (Wierzb.) Dostál) as a synonym of *H. umbellatum* subsp. *glutinosum*. This synonymy has probably come from the “Atlas Florae Europaeae” (1983) and it was also repeated in the “Flora Europaea” (Walters, Akeroyd, 1993). We studied the original material on *H. heuffelii* from Romania on the Global Plants web-service (HAL0118102 and HAL0118103) and can state without doubts that the plants on both sheets belong to *H. umbellatum* instead of *H. glutinosum*. Moreover, we failed to find any specimens of *H. glutinosum* from any European country except Russia (see also Greimler, 2001). Thus, the authors who treat *H. glutinosum* as a subtaxon of *H. umbellatum* may actually be not familiar with true *H. glutinosum*.

What is *Holosteum liniflorum*?

The name *H. liniflorum* Steven ex Fisch. et C. A. Mey. was originally published in F. E. L. Fischer et al. (1837). The authors applied this name to the “glaucous” species with 10 stamens occurred in the Crimea and the area adjacent to the Caspian Sea. Thus, *H. liniflorum* was listed there with a half-wrong description, which contained some characters of both “glaucous” and “green” species. *Arenaria glutinosa* was cited as a synonym of *H. liniflorum* (Fischer et al., 1837). Thus, the latter name is illegitimate according to the Art. 52.1, 52.2(e) of ICN (Turland et al., 2018).

Three years later the same authors published a new combination *H. glutinosum* applied to the “glaucous” species (“*H. glaucum*; <...> petalis oblongis subintegerrimis longitudine latitudineque sepala vix excedentibus”) (Fischer et al., 1840: 52) instead of the previously published *H. liniflorum*. At the same time, they provided a new diagnosis for *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837]: “*H. viride*; <...> petalis obovatis integerrimis latitudine longitudineque sepala multo superantibus” (Fischer et al., 1840: 52). The latter

name was applied to the plants from the Crimea, which clearly belonged to the “green” species, although this name was again illegitimate according to the Art. 53.1 of ICN (Turland et al., 2018) due to the homonymy with *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1837. Modern taxonomic databases such as Euro+Med PlantBase (Marhold, 2011) or World Flora Online (2020) usually provide only the “earlier” *H. liniflorum* (published in 1837) among the synonyms of *H. umbellatum* subsp. *glutinosum* but miss the name published in 1840. Only A. S. Zernov and I. V. Sokolov (2004) listed both the “earlier” and the “later” *H. liniflorum*, although they also did not take into account their different diagnoses and treated both names as synonyms of *H. umbellatum* var. *glutinosum*, nom. superfl.

We can confirm that the Crimean *H. glutinosum* (Fig. 2) has very peculiar large petals, resembling those of a flax (“*liniflorum*”), and merits its own name, however at the rank of subspecies. After extensive study of the literature, we are not aware that any legitimate name at subspecies rank has been previously published for the taxon that used to be named “*H. liniflorum* Steven ex Fisch. et C. A. Mey.” 1840 [non 1837] and therefore a new name is proposed in the present paper (see below).

Taxonomy

Holosteum glutinosum (M. Bieb.) Fisch. et C. A. Mey. 1840, Index Sem. Hort. Petrop. 6: 52. \equiv *Arenaria glutinosa* M. Bieb. 1808, Fl. Taur.-Caucas. 1: 344. \equiv *Holosteum liniflorum* Steven ex Fisch. et C. A. Mey. 1837, Index Sem. Hort. Petrop. 3: 39, nom. illeg. superfl. [Art. 52.1, 52.2(e) of ICN (Turland et al., 2018)]. \equiv *Holosteum umbellatum* β [var.] *pleiandrum* Fenzl in Ledeb. 1842, Fl. Ross. (Ledeb.) 1: 374¹. \equiv *Holosteum umbellatum* β [var.] *glutinosum* (M. Bieb.) J. Gay, 1845, Ann. Sci. Nat., Bot. sér. 3, 4: 33, nom. superfl. [Art. 52.1, 52.2(e), 52.4 of ICN (Turland et al., 2018)]. \equiv *Holosteum umbellatum* subsp. *glutinosum* (M. Bieb.) Nyman, 1878, Consp. Fl. Eur. 1: 112.

Type locality: “in sabuletis deserti inter Astrachan et Kisljar” [Russia]. Lectotypus (Lazkov, Zer-

¹ Lectotypus (Fateryga, **hic designatus**): “Ex sabulis deserti Cumani. a. 1798” (LE: LE01017379). Since E. Fenzl (1842) cited “*H. an glutinosi* var.? <...> C. Koch in Linnaea XV, p. 708. Nr. 180” (Koch, 1841: 708) among synonyms of his *H. umbellatum* var. *pleiandrum*, the latter name in not a replacement name, and is not automatically typified [Art. 6.11–6.13 of ICN (Turland et al., 2018)]. It is typified here by the earlier designated lectotype of *Arenaria glutinosa* (Zernov, Sokolov, 2004).

nov in Zernov, Sokolov, 2004, *Novosti Sist. Vyssh. Rast.* 36: 109): “Ex sabulis deserti Cumani. a. 1798” (LE: LE01017379) (Fig. 4).

= *Holosteum glandulosum* Bertol. 1842, *Misc. Bot.* (Bertol.) 1: 11. ≡ *Holosteum imberbe* J. Gay, 1845, *Ann. Sci. Nat., Bot. sér.* 3, 4: 37, nom. illeg. superfl. [Art. 52.1, 52.2(e) of ICN (Turland et al., 2018)]. ≡ *Holosteum imberbe* α [var.] *brachypetalum* J. Gay, 1845, *Ann. Sci. Nat., Bot. sér.* 3, 4: 40.

Type locality: “Ex portu William in saxis conglomeratis” [Iraq]. Lectotypus (Fatoryga, **hic designatus**): “Colonel Chesney’s Expedition to the Euphrates. No. 16. Port William, March 1836. Breccia rocks; rare” (left-hand specimen, BOLO) (Fig. 5).

Diagnosis: Leaves and sepals pure green, completely covered with dense glandular hairs as well as stem and pedicels; bracts green, completely herbaceous, glandularly pubescent; upper leaves lanceolate; stamens 10; petals entire, longer than sepals.

Notes: When publishing the name *H. imberbe*, J. Gay (1845) listed several other names of species rank as the synonyms of its varieties. Among them, *H. glandulosum* was cited as a synonym of *H. imberbe* α [var.] *brachypetalum* while *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837] was cited as a synonym of *H. imberbe* β [var.] *macropetalum* J. Gay. We are here typifying both *H. imberbe* and *H. imberbe* var. *brachypetalum* by the same element as *H. glandulosum*. The herbarium sheet stored in BOLO and inscribed by A. Bertoloni is no doubt the original material of *H. glandulosum* (Fig. 5). However, it consists of three plants of two different species: two left-hand plants belong to *H. glutinosum* while the right-hand one is *H. umbellatum*. Therefore, one of the left-hand plants is designated as the lectotype (Fig. 5). To notice, the duplicates of the Colonel Chesney’s Expedition to the Euphrates were distributed in different Herbaria, so the isolectotypes of *H. glandulosum* can be found elsewhere. For example, J. Gay (1845) reported that he had seen the F. R. Chesney’s specimen no. 16 in the herbarium of J. P. B. Delessert, which is at present stored in G.

One more name, *H. polygamum* K. Koch, is dubious. It was treated as a synonym of *H. umbellatum* var. *pleiandrum* by E. Fenzl (1842), *H. imberbe* by J. Gay (1845), and *H. glutinosum* by O. A. Muravyeva (1936), although it is impossible to ascertain even whether it really belongs to the genus *Holosteum* due to its unclear diagnosis and the absence of the type material (see Zernov, Sokolov, 2004). T. A. Adylov (1971) even treated *H. polygamum* as an ac-

cepted species erroneously using this name instead of *H. glutinosum* while S. K. Czerepanov (1995) accepted both *H. glutinosum* and *H. polygamum*.

Holosteum glutinosum* subsp. *glutinosum

Diagnosis: Plants rather erect or often somewhat ascending; petals elliptic, usually about 1.5 times as long as sepals, usually not overlapping on margins.

Distribution: Caspian Depression, Transcaucasia, Western and Middle Asia. Records from European countries other than Russia seem to be erroneous and come from either incorrectly identified material or incorrect synonymization (e. g., with *H. heuffelii*, see above).

Holosteum glutinosum* subsp. *liniflorum

Fatoryga, **nom. et stat. nov.** ≡ *Holosteum liniflorum* Steven ex Fisch. et C. A. Mey. 1840, *Index Sem. Hort. Petrop.* 6: 52, nom. illeg. (homonym of *Holosteum liniflorum* Steven ex Fisch. et C. A. Mey. 1837) [Art. 53.1 of ICN (Turland et al., 2018)]. ≡ *Holosteum imberbe* β [var.] *macropetalum* J. Gay, 1845, *Ann. Sci. Nat., Bot. sér.* 3, 4: 41.

Type locality: “Tauria” [Russia: Crimea]. Lectotypus (Taponen, **hic designatus**): “Alifke ad Salgirum Taur. camp. in agris” (H: H1334769) (Fig. 6).

Diagnosis: Plants always erect; petals obovate, about 2 times as long as sepals, always distinctly overlapping on margins.

Distribution: Presumably endemic to the Crimea.

Note: Both *H. liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837] and *H. imberbe* var. *macropetalum* are lectotypified here by the same specimen.

Key to species and subspecies of the genus *Holosteum*

1. Plants without glandular pubescence; stem and pedicels completely glabrous; leaves with or without simple hairs; bracts relatively large, about half as long as sepals or longer, herbaceous with membranous margins; stamens 10; plants of subalpine habitats and grassy mountain slopes at high elevation 2
- + Plants usually with glandular pubescence at least on lower part of stem or/and lower leaves; bracts usually very small, often unnoticeable, several times shorter than sepals, either completely herbaceous or membranous; stamens in various number; plants of various habitats, often ruderal or segetal 3



Fig. 4. Lectotype of *Arenaria glutinosa* M. Bieb. (LE: LE01017379). Upper part of one plant is shown enlarged on the left top; arrow indicates a bract, which is completely herbaceous.

2. Upper pair of leaves with pubescent margins; pedicels becoming pendant after flowering but then erect again when fruits mature; seeds usually longer than 1 mm (Alps)
 *H. breistrofferi* Greuter et Charpin
 + Upper pair of leaves glabrous; pedicels always erect, even in early fruits; seeds usually about 1 mm long (Crimea, Caucasus, Asia Minor to Iran)
 *H. marginatum* C. A. Mey.

3. Leaves and sepals pure green, completely covered with dense glandular hairs as well as stem

and pedicels; bracts green, completely herbaceous, glandularly pubescent; upper leaves lanceolate; stamens 10; petals entire, longer than sepals 4
 + Leaves and sepals green with glaucous tincture; glandular pubescence varies in density, usually there are some areas without hairs either on stem/pedicels or leaves/sepals/bracts; bracts whitish, rather membranous, often glabrous; upper leaves ovate; stamens in various number; petals either entire or with dentate apical margin, of various length 5



Fig. 5. Lectotype of *Holosteum glandulosum* Bertol. (left-hand specimen indicated by an arrow, BOLO). Courtesy of Alma Mater Studiorum University of Bologna – Sistema Museale di Ateneo – Orto botanico ed Erbario.



Fig. 6. Lectotype of *Holosteum liniflorum* Steven ex Fisch. et C. A. Mey. 1840 [non 1837], nom. illeg. (H: H1334769).

4. Plants rather erect or often somewhat ascending; petals elliptic, usually about 1.5 times as long as sepals, usually not overlapping on margins (Caspian Depression, Transcaucasia, Western and Middle Asia) *H. glutinosum* (M. Bieb.) Fisch. et C. A. Mey. subsp. *glutinosum*

+ Plants always erect; petals obovate, about 2 times as long as sepals, always distinctly overlapping on margins (Crimea) *H. glutinosum* subsp. *liniflorum* Fateryga, nom. et stat. nov.

5. Stamens 10; petals entire, about 2 times as long as sepals, distinctly overlapping on margins (Asia Minor, also reported from Greece by Willing, Willing, 2009) *H. tenerrimum* Boiss.

+ Stamens usually 5; petals usually with dentate apical margin, about as long as sepals or slightly longer, not overlapping on margins (most part of Europe, west of North Africa, Caucasus, Western and Middle Asia; introduced to North and South America and South Africa) *H. umbellatum* L.

Conclusions

The genus *Holosteum* comprises five well recognized species: *H. breistrofferi*, *H. glutinosum*, *H. marginatum*, *H. tenerrimum*, and *H. umbellatum*. Among them, *H. glutinosum* has unique characters such as pure green color of leaves and sepals, completely herbaceous bracts, and lanceolate leaves. The distribution of this species includes the Crimea, Caspian Depression, Transcaucasia,

Western and Middle Asia. Reports of the species from most European countries (other than Russia) are doubtful and therefore its detailed range requires further study. Two subspecies are recognized within *H. glutinosum*: *H. glutinosum* subsp. *glutinosum* distributed over the most part of the species range and *H. glutinosum* subsp. *liniflorum* presumably endemic to the Crimea.

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