

## Critical remarks of *Cerastium subtetrandrum* Murb.

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### Abstract

After critical review of taxonomic characters of *Cerastium subtetrandrum* Murb. the author proposes to reduce this taxon to the status of a form of *Cerastium pumilum* s.s.

### INTRODUCTION

During a systematic revision of Polish species of the genus *Cerastium* of section *Fugacia*, particular attention was paid to *Cerastium subtetrandrum* Murb. reported from Poland by Kulczyński (1921) and Szafer, Kulczyński and Pawłowski (1953). In the literature it was reported in two regions of Poland, namely the sea-shore of the Baltic and the Białowieża Forest. Unfortunately, neither the original sources were available for were specimens with characteristics corresponding to this taxon found in herbarium materials. Detailed observations of this taxon were made and this work contains a few suggestions concerning it.

### MATERIAL

To make the observation of the characters of *C. subtetrandrum* easier comparative materials were borrowed from various herbaria: 8 sheets (107 specimens) from the herbaria of Gratz and Copenhagen and 6 sheets (32 specimens) from Polish herbaria (Table 1). All specimens of Gratz had been revised by Möschl (Nos. of revision — 2015, 2014, 2017; the number of the fourth sheet was not noted). One sheet came from Herbarium Europeum published by Dr. Baenitz (No. 7165). It was collected by Murbeck in locus classicus *C. subtetrandrum* in South Scania between Limhamn and Malmö (it is probably a double syntype). As the taxon is rather rare (Hulten 1950 gives 31 localities from Scandinavia) the quantity of materials may be

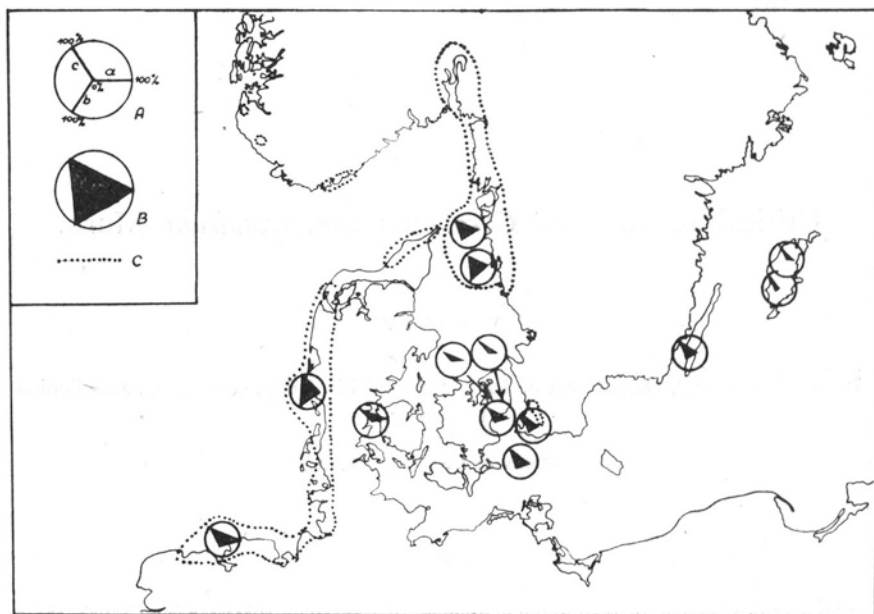


Fig. 1. Distribution of characters of *Cerastium tetrandrum* Curt. (%) in populations of *C. tetrandrum* and *C. pumilum* Curt. subsp. *pumilum* f. *subtetrandrum* Lange

A — empty circle, 100% of characters of *C. pumilum* subsp. *pumilum* f. *pumilum*: a — percentage of tetramerous flowers in population, b — percentage of examples with inflorescences longer than the other part of stem, c — percentage of examples with pentamerous flowers in population; B — circle with black patch triangle in population, 100% characters of *C. tetrandrum*; C — bound of *C. tetrandrum* range

estimated as sufficient. All more important centres of occurrence of the taxon are represented in the material (Fig. 1) namely the Danish islands Amager and Saltholm (so far the only localities known in Denmark), the island Aarö belonging to Schleswig-Holstein (Hukten 1950 and Christiansen 1953 do not give this locality), the above-mentioned locality from South Scania, the islands Öland and Gotland, as well as specimens from Burgerland (Austria).

#### DISCUSSION

The following characters distinguishing *C. subtetrandrum* from *C. pumilum* Curt. subsp. *pumilum* are given in the literature:

- all bracts unscaricus (in *C. pumilum* subsp. *pumilum* at least the upper ones narrow membranes).
- presence of a certain number of tetramerous flowers in *C. tetrandrum*.
- size of seeds (*C. subtetrandrum* about 0.5 mm *C. pumilum* about 0.7 mm).
- petioles of fruit straight, while in *C. pumilum* subsp. *pumilum* slightly bent
- sepals in *C. subtetrandrum* 7—9 mm, fruit 7—10 mm, while in *C. pumilum* subsp. *pumilum* sepals 4—5 mm, fruit 6—8 mm.

The first of the characters should be examined on a larger scale also taking into consideration its occurrence in *C. tetrandrum* Curt. It is reported by Ascherson and Graebner (1919), Rothmaler (1962, 1966) Sell Witehead (1964 a), Weimarck (1963) for both *C. subtetrandrum* and *C. tetrandrum*, but only for the former species by Kulczyński (1921). The green bracts of *C. subtetrandrum* and *C. tetrandrum* are generally opposed to the unscarious bracts of *C. pumilum* s. l. with the reservation that in *C. pumilum* subsp. *pumilum* the lower bracts are also green. This character specified in many floras is not very good and not very easy to observe below the most significant doubts connected with it are discussed.

1. All species mentioned here have inflorescences of various sizes (the ratio of their length to the rest of the stem will be discussed later). The number of embranchments of inflorescences is not a taxonomic character. Thus within one species with considerably well-developed inflorescences (sometimes with six- or sevenfold embranchments) and poorly branched ones in which petioles of the upper flowers grow from the angles of the lowest bracts can be found. Besides these extreme forms there are all sorts of intermediate ones. Therefore the differentiation of the discussed species on the basis of their upper bracts is often impossible since they possess only one pair of bracts.

2. The lowest bracts in the discussed taxon are almost always unscarious (with the exception of *C. pumilum* subsp. *pumilum* f. *medium* Möschl, where on one specimen both scarious and unscarious lowest bracts can be found), hairy, on both sides and similar to leaves, but the upper bracts, though their membrane is sometimes invisible, are hairy from the outside only and on the inside the epidermis is shiny, membranous and nude. Therefore the description found in many floras that bracts are green and similar to leaves is inaccurate. Taking into account what was said above one can state that the difference between scarious and unscarious bracts is not clear and that all sorts of intermediate forms exist.

3. In three related taxons of the reviewed material, namely *C. tetrandrum*, *C. subtetrandrum* and *C. pumilum* subsp. *pumilum* a more or less distinct membrane was observed on the upper bracts. This character occurred in various degrees in populations of the same species. In *C. tetrandrum* it was relatively the most rare. Perhaps this is correlated with the fact that in this species inflorescences sometimes start at the very bottom of the stalk and this fact may cause the more pronounced and more frequent resemblance of bracts to leaves.

All the three aspects discussed above have led to the recognition of scarious upper bracts as a taxonomically uncertain character. On the basis of the work of Möschl (1936, 1938, 1951, 1964), author of many monographic studies on this group, on characters concerning the lower bracts are of taxonomic importance.

The second character mentioned — the presence of tetramerous flowers — also proved to be very variable. The quantity of tetramerous flowers was calculated in a *C. subtetrandrum* population (Table 1, localities 5—13). The number of specimens in the population with the given percentage of tetramerous flowers was examined as well as the total number of flowers in the population and the number of specimens which had inflorescences longer than the rest of the stem. In part of the examined

populations some individuals without tetramerous flowers were found even though the material was very homogenous. This is probably correlated with the number of flowers on the specimen, and thus the greater or smaller probability of the appearance of the character. The percentage of tetramerous flowers varied from 0 to 100% on different specimens. The data presented in Table 1 were obtained from the available herbarium materials and due to the varying number of specimens are difficult to interpret statistically. For this reason the numbers of specimens in particular groups are given without any additional computations. The percentage of tetramerous flowers in the population of *C. pumilum* was counted for all Polish materials (Fig. 2).

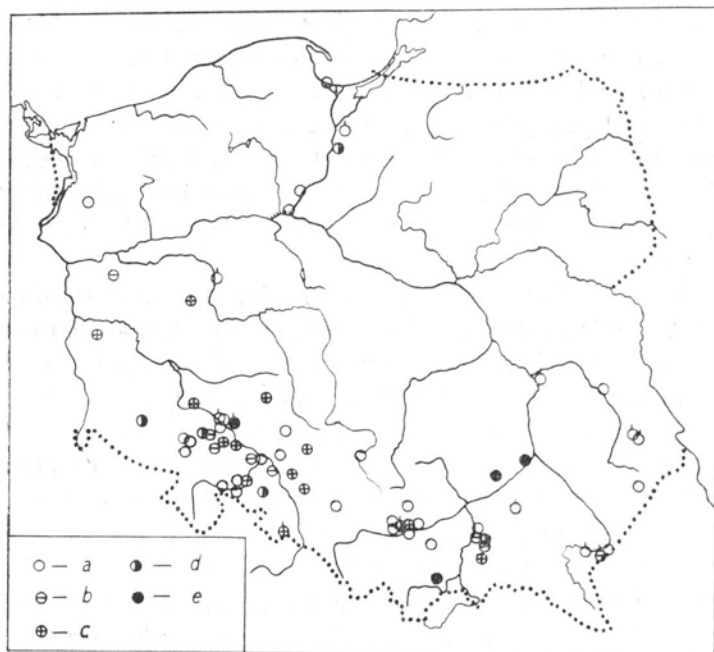


Fig. 2. Percentage of tetramerous flowers in Polish populations of *Cerastium pumilum* Curt. s. l. a — 0 % of tetramerous flowers in population; b — less than 1% of tetramerous flowers in population; c — 1%—5% of tetramerous flowers in population; d — 5%—10% of tetramerous flowers in population; e — above 10 % of tetramerous flowers in population (circle with mark — subsp. *pumilum*, circle without mark — subsp. *pallens*)

Tetramerous flowers were found not only in *C. pumilum* subsp. *pumilum* but also in *C. pumilum* subsp. *pallens*. Data concerning two populations which had the largest number of tetramerous flowers are given in Table 1. In comparison with population 5—15 they have a greater number of specimens without tetramerous flowers (only specimens from locality 6, the Danish island Amager, have a similar number of such specimens). Thus the second of the characters distinguishing *C. pumilum* subsp. *pumilum* from Murbeck's *C. subtetrandrum* proved to be very variable with regard to the occurrence in individuals and in the population. Moreover, its parallel occurrence in both subspecies of *C. pumilum* also does not indicate its high taxonomic standing.



Tabela 1

Comparision of populations of *Cerastium tetrandrum* Curt. (Nos: 1-4), *Cerastium pumilum* Curt. subsp. *pumilum* f. *subtetrandrum* Lange (*C. subtetrandrum* Murb.) (Nos. 5-14) and *Cerastium pumilum* Curt. subsp. *pallens* (F. W. Schultz) Schinz et Thell. f. *subtetrandroides* Zaj. (Nos: 15-16) in respect of percent of *Cerastium tetrandrum* Curt. characters

No.	Locality	Number of specimens of given percent of 4-merous flowers										Percent of 4-merous flowers in over population	General number of specimens	Number of specimens without 4-merous flowers	General number of flower in population	Percent of specimens about inflorescent longer than rest of stem
		C— 10%	10— 20%	20— 30%	30— 40%	40— 50%	50— 60%	60— 70%	70— 80%	80— 90%	90— 100%					
1	Insel Norderney, 11—12.5.1895, lg. W. O. Focke, TRN									1	6	97	7	0	35	36
2	Dania, Zach. Jutlandia, peninsula Skallingen, 4.7.1956, lg. J. Kornaś, KRAM			1	2	2	2	2	1	3	3	67	16	0	177	88
3	Bohuslöh, Vinge et Buskér, 5. 1897, lg. E. Th. et H. Fries, KRA		1	1	2	2	1		2	1		41	11	1	115	62
4	insula Buskér, extra Gothoburgun, 5. 6. 1856, lg. H. G. Lübeck, WRO				1	1	2					51	5	1	79	85
5	Schleswig Holstein: Insel Aarö, 6.1895 lg. Focke, TRN								2	1	2	83	5	0	24	0
6	Amarger, Strandeng ved Kengeleendun, 25. 5. 1920, lg. K. Wiinstedt, C		1	2		2	2	3	1		1	30	16	4	89	0
7	Amager, Strandeng Syd for Drager, 21. 5. 1925, lg. K. Wiinstedt, C			2		1	3	2		1	1	55	10	0	48	0
8	Amarger, Solled ved Kalvebod Strand, 5. 6. 1884, lg. E. Rankior, C	1		4	1	2	3	2	1			46	14	0	220	15
9	Danmark, insula Saltholm, 23.6.1898, lg. C. Ostensfeld-Hansen, C			1	1		1	1				43	4	0	148	39
10	Scania, inter Limhamn et Malmö, 4.6.1887,4.6.1891, lg. Murbeck, WRO, GZU	1	4	1			1					18	7	0	243	36
11	Olandia: Färgertaden, 17.6.1887, lg. L. J. Webolstedt, TRN		1	1		1		2		1		43	7	1	60	36
12	Gotland: Ronehanm, 8. 6. 1898, lg. K. Johansson, GZU	3	2									10	5	0	200	20
13	Gotland: Othern, 10. 5. 1894, lg. M. Ostman, KRA	1	1	2								17	4	0	129	0
14	Burgenland: Ufer einer Salzsee Lacke bei St. Aussee, 27. 5. 1923, lg. K. Rechinger, GZU	4	8	4	6	6	3	1	1			20	51	18	401	9
15	Polska, Sandomierz, Góry Pieprzowe, 29. 5. 1968, lg. A. Zajac, AZ		7	6	2		4		1			18	33	13	190	6
16	Polska, Zachowice, distr. Wrocław, 1. 6. 1962, lg. J. Mądalski, JM	4	5			1						8	14	4	206	0
17	Burgenland: Ad laemas salsas inter Trauenkirchen et Podesdorf, 30. 5. 1926, lg. K. Rechinger, GZU				1		2	1	2			76	6	0	210	100



The third of the characters given has no greater significance as populations of *C. pumilum* subsp. *pumilum* with seeds about 0.5 mm in dimension are frequently found (Zajac unpubl.).

Straight petioles mentioned as a character distinguishing *C. subtetrandrum* from *C. pumilum* subsp. *pumilum* are not observed in the examined material. Moreover, this character also occurs in *C. tetrandrum*.

Sell and Whitehead (1964 a) in addition give different dimensions of fruit and sepals for *C. subtetrandrum* and *C. pumilum*. This character, according to them, also distinguishes *C. subtetrandrum* from *C. tetrandrum*, as the dimensions of the fruits and sepals of the latter are similar to those of *C. pumilum*. Measurements of the available material indicate that there is no basis for such a distinction of the dimensions of fruit and sepals in *C. subtetrandrum* as they correspond to the dimensions given for *C. pumilum* (for which the above-mentioned authors gave values which were too low).

On the basis of the lack of real differentiating characters between *C. pumilum* subsp. *pumilum* and *C. subtetrandrum* it was decided to include the latter in the former with the rank of form. The specimens of subsp. *pallens* which had some tetramerous flowers were treated similarly, and distinguished as a new form, *subtetrandriodes* (Zajac unpubl.)

There are several reasons for this treatment of *C. subtetrandrum*. It shows the same variability as *C. pumilum* subsp. *pumilum*, a fact which has hitherto not been reported in the literature. In *C. pumilum* subsp. *pumilum* two forms were distinguished: f. *pumilum* and f. *medium* Möschl. f. *pumilum* has all bracts in the type of *pumilum* while f. *medium* has some bracts in the type of *pumilum* and some in the type of *pallens* Möschl (personal communication) believes that these are only biotopic modifications. In the material of *C. subtetrandrum*, the presence of specimens which corresponded to both forms was observed. The distribution of *C. pumilum* subsp. *pumilum* and *C. subtetrandrum* on the Scandinavian Peninsula (detailed distribution maps of these taxons exist for this area only) give further, though indirect, evidence. The ranges and even particular localities of both taxonomic units overlap almost entirely, with only a few insignificant exceptions (which may be explained by chance). Thus *C. subtetrandrum* occurs where *C. pumilum* is present. All areas from which *C. subtetrandrum* was reported so far, namely the Scandinavian Peninsula, Denmark, Poland, Lower Austria and Hungary, do not extend beyond the range of *C. pumilum* (Zajac unpubl.)

The presence of tetramerous flowers in such different percentages may be possibly explained by penetrance of *C. tetrandrum* Curt. (general distribution — see Fig. 3). *C. tetrandrum* is the only specimen in this section which has tetramerous flowers (Table 1, localities 1—4), whose range of occurrence lies within that of *C. pumilum*. It differs from *C. pumilum* s. l. by the presence of high percentage of tetramerous flowers and also by the length of inflorescences which is greater than half the length of the whole plant while in *C. pumilum* s. l. the inflorescence makes up 1/3 of the specimen. For this study insufficient material of this species was used to state its taxonomic significance. In any case, only the two opposite sepals may show diffe-

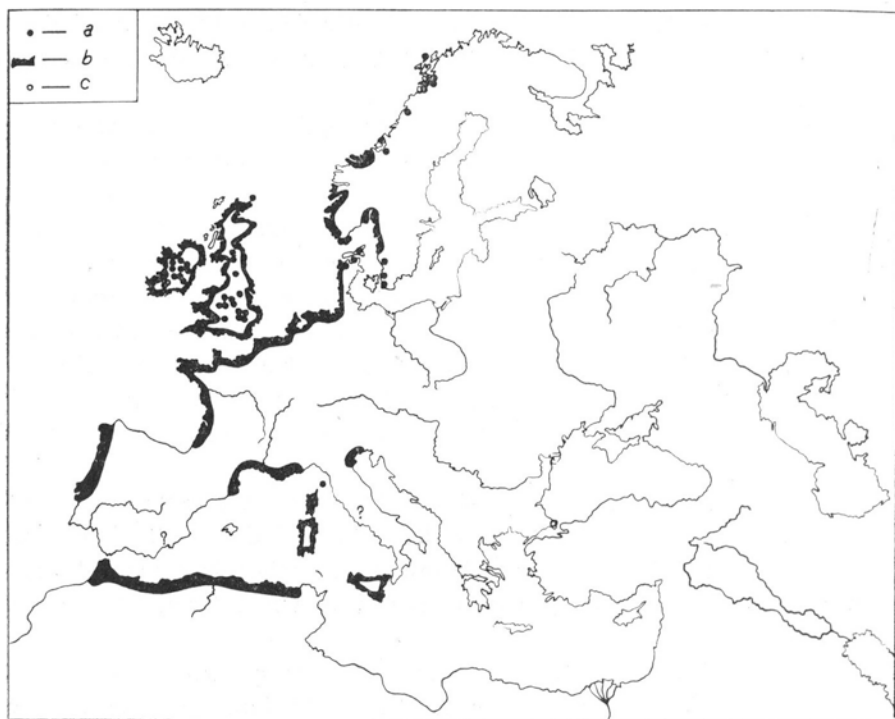


Fig. 3. General distribution of *Cerastium tetrandrum* Curt. (original)

a — distracted localities; b — consistence range; c — synanthropic locality

rentiating characters an the two others generally have a wide membrane comprising the whole sepal. In the literature no mention was found of the existence of hybrids between *C. pumilum* s. l. and *C. tetrandrum*, from this group only *C. glutinosum*  $\times$  *C. subtetrandrum* (Murbeck 1898) is given. But considering its description it is rather a hybrid between *C. glutinosum* and *C. tetrandrum* or else it is a specimen similar to f. *subtetrandroides*.

In order to examine the distribution of the two characters (the third one was not suitable as *C. pumilum* s. l. shows a variable width of membrane and the eventual influence of *C. tetrandrum* is difficult to detect) their proportional participation in *C. subtetrandrum* and *C. tetrandrum* populations was counted and marked on a map (Fig. 1). The appropriate percentages were marked on the radii of circles. As the third character the percentage of specimens with tetramerous flowers in the population was chosen. Closed triangles indicate 100% of *C. tetrandrum* characters (note — according to the diagnosis species with all or almost all tetramerous flowers make up in *C. tetrandrum*), an open circle indicates 100% of features of *C. pumilum*. The range of *C. tetrandrum* in this region was marked. The obtained picture is rather clear. Populations with a great predominance of *C. tetrandrum* characters are found only within its range of occurrence. In the vicinity of Malmö on the southern promontory of Scania (near insular localities of *C. tetrandrum*) the proportional

occurrence of *C. tetrandrum* characters is greater than e.g. in Gotland. These taxons are closely related taxonomically (few differentiating characters and a considerable difference from other species of *Leiopetala* subsection). As can be seen from Fig. 1 and Table 1 penetrance also goes in the other direction as no population of *C. tetrandrum* showed 100% of characters of this taxon. The chromosome numbers of the species mentioned here are as follows: *C. tetrandrum*  $2n=72$  (Blackburn, Morton 1957, Brett 1955), and  $2n=36$  (Wulf 1937, Rohweder 1939). The same number  $2n=72$  was found for *C. subtetrandrum* by Hagerup (1941) on material from Denmark. For *C. pumilum* subsp. *pumilum*  $2n=72$  (Blackburn, Morton 1957),  $2n=90$  (Brett 1952, 1955), Söllner (1954),  $2n=95$  (Brett 1952, 1955),  $2n=94, 96$  (Söllner 1954). Thus the two species appear to have  $2n=72$ , though in *C. pumilum* subsp. *pumilum* this is only one of the possibilities. Thus it is likely that the introgression of *C. tetrandrum* characters might affect only the part of *C. pumilum* subsp. *pumilum* population which has  $2n=72$ . It should be stressed that the dimensions of seeds of a part of the population of *C. pumilum* subsp. *pumilum* and in *C. pumilum* subsp. *pallens* and *C. subtetrandrum* have very similar dimensions (Zajac unpubl). The introgression is very probable, the more so that the characters of tetramerous flowers also occurs in *C. pumilum* subsp. *pallens*; however, its occurrence in areas where no *C. tetrandrum* specimens are present proves that we are dealing with a historical phenomenon.

It is thus necessary to reduce the status of *C. subtetrandrum*. It seems that a return to the conception of Lange (1887) which distinguishes it as *C. pumilum* s. s. f. *subtetrandrum* is correct.

The solution proposed by Soll and Whitehend (1964 a, b) who treat *C. subtetrandrum* and *C. tetrandrum* as subspecies of *C. diffusum* Pers (syn. *C. tetrandrum* Curt.) is not acceptable due to the taxonomic inequality of the taxons joined in one taxonomic unit. Besides them a species of *C. gussonei* Tod. ex Lojac., distantly related to them, was included in this unit of classification with the rank of subspecies.

The problem of *C. subtetrandrum* requires further investigations which must be undertaken on more material by cytologists and embryologists. Only a hypothesis of the origin of this taxon was put forward in the present study.

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### Krytyczne uwagi o *Cerastium subtetrandrum* Murb.

#### Streszczenie

W sekcji *Fugacia* rodzaju *Cerastium* L., zlikwidowano gatunek *C. subtetrandrum* Murb. przyznając mu tylko rangę formy w obrębie *C. pumilum* subsp. *pumilum*. Ten krok uzasadniono:

- faktem, iż żadna z cech podanych dla *C. subtetrandrum* jako odróżniająca od *C. pumilum* subsp. *pumilum* nie okazała się stałą dla tego taksonu (dotyczy to również okazów oznaczonych przez autora gatunku Murbecka i wybitnego specjalistę w tej grupie Möschla);
- podobnym rozmieszczeniem lokalnym *C. subtetrandrum* i *C. pumilum* subsp. *pumilum* w Skandynawii (tj. na jednym jak dotąd terenie, gdzie zostało ono lepiej zbadane (Hulten 1950);
- znalezieniem czterokrotnych kwiatów także na okazach *C. pumilum* subsp. *pallens*, co zaznaczono wyróżniając okazy o pewnym procencie kwiatów czterokrotnych jako nową formę (*f. subtetrandroides* Zaj.).