

# VISION OF GYPSOPHILA, BOLANTHUS, ANKYROPETALUM AND PHRYNA<sup>1</sup>

(With Arabic summary)

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## INTRODUCTION

*Die Gattung ist schwierig zu umgrenzen, da sie sehr nahe Beziehungen zeigt zu Saponaria und Acanthophyllum.*

PAX und HOFFMANN

This work was undertaken at the suggestion of Dr. J. Lanjouw and Dr. F. P. Jonker. The citation heading this paragraph indicates that the group of *Caryophyllaceae* with which it deals, presents unusual taxonomic difficulties. At first, it was intended to restrict the revision to the genus *Gypsophila*. However, in the course of the work it was realized that the small genera *Bolanthus*, *Ankyropetalum* and *Phryna* could not be left out of account as they had been regarded by some authors as subdivisions of *Gypsophila* and by others as near relatives of this genus. For this reason a complete revision of these genera too was included.

The only previous revision of *Gypsophila* is that published by WILLIAMS (1889). His study, largely based on data derived from the literature, includes 76 species i.e. about  $\frac{3}{5}$ th of the number recognized here. His views on the generic limits were strongly influenced by those expressed by BENTHAM in BENTHAM and HOOKER's *Genera Plantarum* 1 (1862). Later authors did not follow him in this respect, and generally preferred BOISSIER's delimitation (1867), so e.g. PAX and HOFFMANN in the 2nd Edition of ENGLER und PRANTL, *Planzenfam.* (1934). PAX had already accepted this delimitation in the first edition (1889).

With regard to the delimitation of the genus as well as to its subdivisions the present author agrees largely with WILLIAMS (1889), and less so with BOISSIER (1867). The sections *Pseudoacanthophyllum* Boiss. and *Jordania* Boiss., included by Boissier in *Gypsophila*, are transferred here to *Acanthophyllum*. The section *Bolanthus* Boiss., included in *Gypsophila* by Boissier and in *Saponaria* by Williams, is treated in the present work as a separate genus; the same is done with *Ankyropetalum*, which Williams included in *Gypsophila*. The subsection *Vittatae* Williams (of the section *Macrorrhizaea* Boiss., which is regarded in this work as a subgenus of *Gypsophila*), is transferred here to *Saponaria*. *Gypsophila montana* Balf. is transferred to *Saponaria*; *G. alsinoides* Bunge to *Arenaria*.

In Williams' revision (1889) 76 *Gypsophila* species were recognized; of these 8 are excluded in the present paper. Of those species which were described afterwards, 31 are recognized here; with the 19 species described in this work this makes 50; the inclusion of

these 50 species made it necessary to distinguish 2 new sections, 3 new subsections and 2 new series.

In the present revision therefore 126 species of *Gypsophila* are recognized. Of these 19 are new; besides, 1 new subspecies and 2 new varieties are described. At the end follows a list of names of uncertain application.

Out of the very many species of this group of genera, only nine, all of them native to Syria, were known to the author in the field. This deficiency suggested the idea that it would be worth-while to grow as many species as possible in the garden. Mr. E. A. Mennega, to whom the author is much indebted, succeeded in securing seed samples of 21 different species from other botanical gardens. Not all the seed samples which were received were correctly named; in fact, misidentification of *Gypsophila* species appeared to be more frequent in botanical gardens than in herbariums. Though the climatic conditions in the Netherlands are not favourable for growing *Gypsophila* species, the gardener of Cantonspark (Baarn) succeeded in bringing some of these species to flower. The section dealing with general morphology is based largely on material collected from these living plants.

The author used this material also for studying the cytology of these species. However, this part of the work did not yield many results, in the first place because these plants were mostly well-known horticultural or else European species which had already been studied cytologically, and also because they represented only 2 sections of the genus *Gypsophila* and because no critical species were among them. The author intends to continue in the future his investigations in this direction.

It is hoped that the present revision will help to clear up the taxonomic position of these genera. The author realizes that some of the problems concerning the relation of these genera with other members of the tribe *Diantheae* still remain to be solved. Cytotaxonomic studies would presumably contribute valuable data. This applies especially to the genera *Acanthophyllum*, *Bolanthus*, *Ankyropetalum* and *Phryna* and to those *Gypsophila* species which seem to approach these genera. Comparative ecological research too might help to understand the differentiation of the species. A study of this kind would be particularly interesting where closely related species are found to inhabit adjacent geographic areas.

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## A. GENERAL PART

## 1. LIMITS OF THE GENUS AND REVISION OF LITERATURE

The name *Gypsophila* was mentioned for the first time in LINNÉ's Diss. Chen.: 41 (1751). There, Linné described 7 species of *Gypsophila*, out of which one was afterwards removed to *Arenaria* and another one to *Tunica*. Later, Linné described 2 other species, one of which was also a *Tunica*. That Linné failed to recognize the difference between *Tunica* and *Gypsophila* was due to the purely numerical basis of his system. Apparently, Linné did not consider HALLER's work, Stirp. Helv. 1: 381 (1742), where *Tunica* was regarded as a separate genus. SCOPOLI (1772) revised Linné's work, and made the boundaries between *Gypsophila* and *Tunica* sufficiently clear. BENTHAM in BENTHAM and HOOKER (1862) made the difference quite pronounced by referring the two genera to two different subtribes of the tribe *Sileneae*; in the latter he distinguished three subtribes, viz. *Diantheae* (*Tunica*), *Drypideae* and *Sileneae* (*Gypsophila*), according to the seed and embryo shape. The mistake made by DESFONTAINE (1800), SIBTHORP and SMITH (1806), SERINGE in DC. Prod. (1824), BUNGE in LEDEBOUR, Fl. Ross. (1842), GRISEBACH (1843), DUFOUR (1860) and JANKA (1867), by neglecting the differences between *Tunica* and *Gypsophila*, has very seldom been repeated in modern literature. The peltate seed with facial hilum, the straight embryo placed in the middle of the seed, viz. with the endosperm all around, i.e. also on the dorsal side of the seed, are characters which do not occur in any *Gypsophila* species. Moreover, the grass-like habit and the presence of stigmatic papillae all along the styles are typical *Tunica* characters which are very rarely met in *Gypsophila*.

It is true that *Gypsophila caricifolia* Boiss. and *Gypsophila graminifolia* Bark. are in their habit more or less similar to *Tunica*, but the flowers, fruits and seeds of these two species are of the kind which is typical for *Gypsophila*. This suggests that these two species developed in their vegetative organs on lines parallel to those in which the vegetative parts of *Tunica* were differentiated; this however, does not mean that there exists a near relation between these two genera.

The difference between *Gypsophila* and *Saponaria* too was not clear to Linné, for he put *Gypsophila porrigens* (L.) Boiss. in *Saponaria*; at an earlier date he had referred it to *Silene*. LAMARCK, Fl. Fr. (1778) did not accept *Gypsophila* as a separate genus, and inserted its species in *Saponaria*. A. BRAUN (1843) says that though it is easy to separate *Saponaria* from the other genera of the *Lychnideae*, it is very difficult to distinguish it from *Gypsophila*. BENTHAM (1862) says that *Gypsophila* and *Saponaria* are so intimately blended with each other that no distinct boundary line can be drawn between them, and some of the small-flowered species may according to him with almost equal right be referred to the one as to the other. BOISSIER (1867) draws



attention to the points of resemblance found between the sections *Macrorrhizaea*, *Bolanthus* and *Hagenia* of *Gypsophila* on the one hand and the genus *Saponaria* on the other, but as he regards the differences in the shape of seed and embryo as more important than the points in which they resemble the genus *Saponaria*, he inserts these sections under *Gypsophila*, though at an earlier date most of the species belonging to them had been referred by him to *Saponaria*. SIMMLER (1910) says that the possibility of finding a well-defined boundary line between *Gypsophila* and *Saponaria* is greatly hampered by the presence of countless intermediate forms, though in general these genera are quite different. NEUMAYER (1921) unites *Gypsophila* with *Saponaria* under the name of the latter. PAX and HOFFMANN (1934) say "Die Gattung ist schwierig zu umgrenzen, da sie sehr nahe Beziehungen zeigt zu *Saponaria* und *Acanthophyllum*". They follow in the main Boissier's delimitation though accepting the small changes which had been introduced by Williams in the latter. ŠIŠKIN (1936) too accepts Boissier's delimitation of *Gypsophila* from *Saponaria*.

After studying the species *Saponaria ocymoides* L., *S. cerastioides* Fisch., *S. orientalis* L., *S. calabria* Guss., *S. bellidifolia* Sm. on the one hand, and *Gypsophila picta* Boiss., *G. floribunda* (Kar. et Kir) Turcz. and *G. kermanensis* (Bornm.) Stroh on the other, the present author arrived at the conclusion that the character "Unguem petalorum non lamellatum, seminis radicula elongata" which were Boissier's main arguments in separating *Gypsophila* from *Saponaria* can not be regarded as absolutely reliable differences between these two genera.

The embryo of *Saponaria orientalis* and that of *S. cerastioides* have a radicle which is easily recognizable, though not markedly elongate, but in the embryo of *Gypsophila picta* the radicle is certainly not more distinctly elongate than in these two species. In *Gypsophila floribunda* and *G. kermanensis* the elongation of the radicle is more pronounced because the seed is oblong, a character that is related to the length of the funicle and to the position of the seed. The "unguis lamellatus vel non-lamellatus," i.e. the presence or absence of wings along the claw of the petal is not decisive either. *Saponaria cerastioides* has a bare claw, and *S. orientalis* has a very narrow claw with hardly noticeable wings. In *Gypsophila picta* the claw is winged at the base only, in the other *Gypsophila* species, however, it is indeed not winged at all.

Let us now consider some other characters of these three *Gypsophila* species. All of them appear to have foliaceous bracts, a calyx which is better described as cylindrical-tubulose than as campanulate-turbinate, and which is provided with teeth not exceeding the length of the connate part and with green bands separated from each other by very narrow hyaline stripes, the latter containing hardly any calcium oxalate druses; they are further provided with a well-developed androphore, stamens with capillary filaments, a narrowly ovoid ovary, instead of a terminal stigma, a stigmatic surface extending all along the style, and an ovoid capsule opening with small teeth, not a deeply 4-valved one. All these features are more or less typical *Saponaria*

characters which hardly occur in any of the true *Gypsophila* species. Moreover these three species show as a group a greater resemblance to *Saponaria*, when the latter is accepted in its usual delimitation, than to *Gypsophila*. This was recognized already by STROH who, although including these three species in *Gypsophila*, proposed a separate subgenus for them. However, in my opinion, these three species will have to be included in the section *Proteinia* Boiss. of *Saponaria*.

The species *Gypsophila bellidifolia* Boiss., *G. biovulata* Stapf and *G. montana* Balf. are another group of nearly related species, and their morphology and geographic distribution suggest that they must have sprung from a common ancestral stock. The cauline leaves of these species, to which one of them owes the epithet "bellidifolia", are spatulate with narrowed base. The only other species in which this type of leaves is present, is the otherwise totally different *Gypsophila cerastioides* Don. The bracts are small but foliaceous; the calyx is in *G. bellidifolia* tubulose, in *G. montana* campanulate, but the green bands are broader than the hyaline ones and in the latter only very minute druses occur or none at all; the petals in *G. bellidifolia* have a line of long hairs at the base of the limb; the stamens are as long as the calyx or shorter; an androphore is recognizable; the ovary is elongately ovoid; the stigmatic surface extends all along the inner side of the styles; the capsule is narrowly ovoid and toothed; the seed has a prominent radicle but is flat or concave at the back; the embryo has flat cotyledons. In all these characters these three species show a greater resemblance with *Saponaria* than with *Gypsophila*. In my opinion they have, therefore, to be excluded from *Gypsophila* and to be transferred to *Saponaria*.

*Gypsophila muralis* L. occupies a special position. The ruderal habitat, the wide distribution, and the very small size of the chromosomes suggest that this species may be a very ancient one. It is true that it shows a strong resemblance to the species of *Saponaria* section *Proteinia* Boiss., but the morphology of *G. muralis* is apparently obscured by its polymorphism, which perhaps reflects its great age. As the chromosome number of *G. muralis* (17) agrees with the basic chromosome number of *Gypsophila* and not with that of *Saponaria* (15), and as this species resembles the species of the subgenus *Macrorrhizaea* of *Gypsophila* e.g. in the structure of the inflorescence and in the small size of the seeds, I decided to keep it in *Gypsophila*, though I have to admit that some of its characters are typical *Saponaria* ones.

In general, *Gypsophila* differs from *Saponaria* by its small flowers, by its more or less turbinate calyx with broad hyaline bands and with a single main nerve instead of a net of nerves in the green bands, by the fact that its petals but seldom show a differentiation in claw and limb and when they do only a very slight one, by the always bare basal part of the petals and by the absence of a corona, by the fact that the filaments are thicker at the base and not equally thin over their whole length, by the presence of terminal stigmata instead of stigmatic surfaces extending all along the styles, by a very

reduced androphore which forms a thick disc and by the ear-shaped, on both sides compressed instead of reniform-globose seeds, and an embryo which is provided with a prominent radicle and which forms an open ring with one end projecting instead of a completely closed one. In both genera, however, the embryo is peripheral with a central endosperm.

With regard to the boundary line between *Gypsophila* and *Acanthophyllum*, BOISSIER (1867) says that the species of the section *Pseudoacanthophyllum* of *Gypsophila* are "faciē *Acanthophylli*, nexum inter hoc genus et *Gypsophila* proebentes". At an earlier date one of the species of this same section had actually been described by him under *Acanthophyllum*; it was subsequently shifted by him to *Gypsophila*. BENTHAM in BENTHAM and HOOKER (1862) and afterwards WILLIAMS (1889) exclude the sections *Jordania* and *Pseudoacanthophyllum* from *Gypsophila* and transfer them to *Acanthophyllum*. BAILLON (1888) adds the genera *Jordania* Boiss. and *Acanthophyllum* to *Drypis*. GOLENKIN (1893), on the other hand, follows Boissier. Though PAX and HOFFMANN (1934) regard Williams' opinion on this same point as worth considering, they too prefer to follow Boissier, just as PAX did already in the 1st ed. of ENGLER u. PRANTL, Pflanzenfam. (1889). ŠIŠKIN does the same (1936).

GOLENKIN (1893) regards the similarity in habit which some *Gypsophila* species show with *Acanthophyllum*, as an adaptation to similar life conditions, viz. to a dry climate and to the attacks of grazing animals. I will not enter here into a discussion of the difference and the limits between adaptation and heredity; I will confine myself to the remark that the small plants (which unfortunately did not flower) grown in the botanical garden "Cantonspark" (Baarn) from seeds obtained from Hort. Bot. Acad. Sc. RSS. Turcmanicae (*Acanthophyllum microcephalum*, *A. leiostegium* Wed., *A. mucronatum* Mey., *A. spinosum* Mey.) were distinctly spiny though they were exposed to an atlantic climate. The spiny sclerified leaves and the rigid stem are characters which, though their development may originally have been favoured by selection on account of their ecological value, are now hereditary and therefore taxonomically important.

As a matter of fact, the sections *Jordania* Boiss. and *Pseudoacanthophyllum* Boiss. of *Gypsophila* are very different from the rest of the genus. For that reason STROH (1939) raised them to the rank of subgenera. In reality, these sections are not only externally similar to *Acanthophyllum*, but also in their anatomical characters. OLIVER (1859), to whom *Gypsophila laxiflora* (Boiss.) Reching. f. still was *Acanthophyllum laxiflorum* Boiss., showed in a detailed histological study of the stem and the leaves that this species agrees in its anatomical abnormality with the other *Acanthophyllum* species, that is to say that the vascular ring in the stem is split up by parenchyma plates that originate from the cambium in small bundles. These plates break the vascular ring in pieces which differ in size from one species to the other. They are quite irregular in shape; but they

connect the pith with the cortex and are similar to the cortex in their staining capacity. Cross sections made by me through the stem of some typical *Gypsophila* species (*Gypsophila perfoliata*, *G. paniculata*, *G. muralis*, *G. elegans*, *G. repens*, *G. spergulifolia*) showed that the vascular system forms in these species always a complete ring, just as it does in *Saponaria* (SIMMLER, 1910).

The shape, texture and dehiscence of the capsule were regarded by several authors, following BRAUN (1843), as good differential characters between *Gypsophila* and *Acanthophyllum*. Though these characters are doubtless very important, they were insufficiently studied by these authors. In many species of *Tunica*, *Gypsophila* and *Acanthophyllum* the upper part of the ovary is firmer and thicker than the lower part. The thicker this upper part of the ovary is, the more difficult the dehiscence of the capsule into 4 valves becomes. *Gypsophila arrostii* Guss., for example, is a typical *Gypsophila* species, but for the last-mentioned reason its fruit seldom splits into 4 valves. The same applies to the species of the section *Capituliformes* Williams of *Gypsophila*. On the other hand, although it is true that the fruit of *Acanthophyllum* generally does not split clearly into 4 valves, there are a few species, like *A. knorringianum* Šiškin, to which this does not apply. Therefore, this fruit can not be regarded as essentially different in structure from that of *Gypsophila*, as the reason why it does not always open clearly, is more or less accidental. The limited number of ovules, and the fact that but one of them develops into a seed, seem to make the dehiscence of the fruit less urgent. Moreover, when the fruit is ripe, it is still completely surrounded by the calyx which moreover has grown dry and hard, and so there is no space for the dehiscence of the fruit. As the fruit is enclosed within the calyx, it is not exposed to the desiccating effect of the dry air, with the result that it does not develop its opening mechanism. When the fruit is sufficiently long to reach the level of the calyx teeth, the splitting into 4 valves may take place, and this is what happens in *Acanthophyllum knorringianum* and in all *Gypsophila* species belonging to the sections *Jordania* and *Pseudoacanthophyllum*. The same happens in *Acanthophyllum* subg. *Allochrusa*.

In the sections *Jordania* and *Pseudoacanthophyllum* as well as in *Acanthophyllum* the seed is oblongoid, not auriform as in the true representatives of *Gypsophila*; the embryo is unciform, and this shape is not met in any true *Gypsophila* species. The presence of tubercles on the testa, which by some authors was regarded as a sharp differential character between *Acanthophyllum* and *Gypsophila*, can not be accepted as such, for *Gypsophila tomentosa* L., which is a quite normal *Gypsophila* species, has smooth and shining seeds, whereas *Acanthophyllum microcephalum* and *A. knorringianum* have seeds covered with tubercles. Similar tuberculate seeds are found in species belonging to the sections *Jordania* and *Pseudoacanthophyllum* of *Gypsophila*.

The differences between the genus *Gypsophila* and the genus

*Acanthophyllum* can be resumed in the following points; viz.

1. *Acanthophyllum* shows mostly a dense cushion-shaped growth and its leaves are spiny; such a habit and such leaves are found in *Gypsophila* in two species only, viz. in *G. pinifolia* Boiss. and in *G. acantholimoides* Bornm., which in all their other characters are typical *Gypsophila* species.

2. *Acanthophyllum* has a more or less tubiform calyx with thick ribs, which is up to one third divided into small teeth; the calcium oxalate crystals are confined to the ribs. In *Gypsophila* a calyx of this kind is present only in the subgenus *Pseudosaponaria*; all the other characters of this subgenus are typical for *Gypsophila*.

3. *Acanthophyllum* has more or less narrowly spatulate petals provided with a long claw; such a claw is not present in the petals of any *Gypsophila* species.

4. *Acanthophyllum* seeds are oblong with a prominent radicle; such seeds are not present in any *Gypsophila* species.

5. The embryo of *Acanthophyllum* is unciform; no *Gypsophila* species has such an embryo. If this delimitation is accepted, Boissier's sections *Jordania* and *Pseudoacanthophyllum* are to be excluded from *Gypsophila* and to be transferred to *Acanthophyllum*. This has been done in this paper.

The genera *Ankyropetalum* Fenzl, *Phryna* Pax & Hoffmann, and *Bolanthus* (Ser.) Reichenb. are considered to be separate genera and are not included in *Gypsophila*. For the delimitation of these genera and for the points in which they differ from *Gypsophila* see the discussion in the parts of this work that are devoted to them.

## 2. GENERAL MORPHOLOGY

A study of the morphology of the *Gypsophila* species gives a good idea of the variety in form which is met with in the subfamily *Silenoideae*. For *Gypsophila* is not only one of the largest genera of the *Silenoideae*, but also one of the most polymorphous ones. Every part appears in a great variety of forms, so that a study of the different *Gypsophila* species gives a good idea of the way in which the evolution may have proceeded in the whole group.

### a. *The Root*

About 12 % of the species of *Gypsophila* are annual plants. These annual species have a white and thin main root which penetrates perpendicularly and as deep as possible into the soil in search of moisture. *Gypsophila muralis* L. is the only annual plant that forms an exception to this rule; this species has a rather fibrillary, much branched root system that does not penetrate very deep into the soil. This difference may be correlated with the fact that the other *Gypsophila* species are inhabitants of dry steppes, whereas *G. muralis* is a ruderal plant. The majority of the biennial and perennial species have woody main roots that penetrate deep into the soil and into rock cracks, and that are strongly ramified. In these species the

length of the main root mostly exceeds the length of the stem (it is ca. 1 m long).

The roots of *Gypsophila aretioides* Boiss, and *G. imbricata* Rupr. are so thick that they occasionally reach a diameter of 1 m and a weight of up to 150 kg (Korovin on a herbarium sheet in the Leningrad Herbarium). Such thick woody roots are often used as fuel by the population of Turkmenia.

Another peculiar form of root is the tuberous one found in *Gypsophila intricata* Franch. and in *G. bucharica* Fedtschenko. The tubers are oblong or globose in shape and very firm in texture.

Perennial *Gypsophila* species are chamaephytes, which means that the root is the main part of the plant which survives the winter. Every spring several herbaceous (or sometimes more or less woody) shoots arise from the buds near the ground to develop into flowering stems. At the end of the flowering season the stem dies off from the top down to the soil surface. This character as well as the long woody root are usually regarded as adaptations to the conditions prevailing in the dry steppe.

According to ROSSOL (1884), a fair amount of saponin is present in the roots of the *Silenoideae*. In living plants it is dissolved in the vacuoles, but by desiccation or by adsorption it changes into homogeneous, shapeless white or grey lumps. By means of chemical reactions, Rossol found that saponin occurs mainly in the cortex parenchyma, the medullary rays and the wood parenchyma of the root. In Middle-East countries the dry roots of some species of *Silenoideae* are used in making "Halawah". This use rests on the presence of saponin.

#### b. *The Stem*

In most perennial *Gypsophila* species the basal part of the stem forms with the upper part of the root a thick woody caudex. This part of the plant is strongly branched and more or less deeply buried below the soil surface; its branches are mostly cylindrical; in several species it is more or less prostrate.

The rest of the stem is mostly erect and ca. 30 cm in height. In some species, e.g. in *G. serpylloides* Boiss., *G. herniarioides* Boiss. and *G. violacea* (Ledeb.) Fenzl, it rests on the ground. In others it does not exceed a height of a few cm above the soil, so e.g. in *G. aretioides* Boiss. and *G. imbricata* Rupr., while in some others like *G. perfoliata* L. and *G. oldhamiana* Miq. it may reach a height of more than 1 m; in that case the plants become subshrubs. The colour of the stem is mostly glaucous, and it is always cylindrical in form, differing from capillary to 15 mm in diam., and usually hollow, especially in thick-stemmed species. Some species have sclerified stems which persist from one year to the other in the form of erect dry stalks, so e.g. *G. pallida* Stapf and *G. nabelekii* Siškin.

Most *Gypsophila* species have two- or three-forked stems, though some species do not branch at all, e.g. *G. transsylvanica* Spreng. It

is quite possible that the two-forked mode of branching is to be regarded as dichasial, the flower in the fork remaining undeveloped. In *G. elegans* M. Bieb. I saw some plants with as an abnormality accessory side branches which developed below the normal ones from serial buds. This may be interpreted as a special development of a dichasial inflorescence of which the apical growth is inhibited and which accordingly is enabled to produce a larger number of side branches. The three-forked branching may be the result of an equally strong development of the terminal bud and two opposite axillary ones. Most of the shoots with the exception of the lower ones may produce inflorescences, e.g. in *G. acutifolia* Fisch., *G. iberica* Bark. and *G. struthium* L.

The nodes are mostly swollen and surrounded by the connate part of the leaves. In some species, e.g. in *G. arrostii* Guss., *G. capillaris* (Forsk.) Christ. and *G. libanotica* Boiss. the leaves are not connate, and the nodes are quite bare. In *G. acantholimoides* Bornm. and *G. capillaris* (Forsk.) Christ. the stem is articulated at the nodes, and this character favours a wider distribution of the seeds, for these stems are easily broken up, and the wind blows such light plant parts to a great distance.

Many *Gypsophila* species are glabrous, others are more or less hairy. In some species it is only the basal part of the plant which is hairy, in others only the upper part, and then the indumentum may especially be developed above the nodes, whereas a third group is hairy all over. The hairiness differs from puberulent to hirsute. The most common type of hairs are the short ones ending in a small gland, but some species have eglandular hairs, e.g. *G. eriocalyx* Boiss. and *G. lepidioides* Boiss. In glabrous species, the epidermis shows a kind of papillae which cover the whole surface of the plant, so e.g. in *G. transsylvanica* Spreng. and *G. capillaris* (Forsk.) Christ. In some species e.g. in *G. viscosa* Murr., *G. simulatrix* Bornm. et Woronov and *G. curvifolia* Fenzl the internodes and especially the parts just below the nodes are viscous. This is due to the presence of sessile glands.

In a cross section of the stem one sees the epidermis, a thin cortex, a ring of sclerified tissue which differs in thickness from one species to the other, then a ring of vascular tissue, and in the centre the pith. When in the middle of the internode a leaf trace leaves the vascular ring, the ring is interrupted over a certain distance, while the trace deviates towards the periphery of the stem. At the node level the ring is once more closed. In cross sections one can see that the traces of opposite leaves do not arise at the same level. This may be attributed to the spiral origin of this kind of phyllotaxy. At the same time one may note that the vascular tissue of the side branches springs from the stele immediately above the place where the leaf trace of the leaf in whose axil the side branch is developing, departs from the stele.

### c. *The Leaf*

Most *Gypsophila* species have grey-green leaves, but some species, like *G. perfoliata* L. and *G. bicolor* (Sint. et Freyn.) Grossh., have more or less yellowish leaves. In many species the lower leaves form a kind of rosette, because they arise very close to each other. In some species the leaves are more or less imbricated, as in *G. steupii* Šiškin, *G. sambukii* Šiškin and *G. transsylvanica* Spreng. Upwards the leaves are wider apart and smaller, and at last they change into small scarious bracts.

In form the leaves vary from ovate to subulate, lanceolate leaves being most common. In texture they are more or less fleshy and mostly thick. *G. acantholimoides* Bornm. and *G. pinifolia* Boiss. are the only species with leaves ending in a spine. The basal part of the leaf is mostly thinner and connate with the basal part of the opposite leaf.

Every leaf has 3 or more distinct to hardly visible nerves; the main nerve is always well developed, but the side nerves differ in their degree of development according to the width of the leaf. In broad leaves the number of nerves is 5 or more and here they are distinctly visible, but in narrow leaves the main nerve only is to be seen.

In most *Gypsophila* species the epidermis is papillose, especially along the edges of the leaves. This is very clearly seen in *G. capillaris* (Forsk.) Christ and in *G. pallida* Stapf. In shape, the epidermis cells may be square, hexagonal or irregular. Stomata cells may border on 2 cells as in *G. tenuifolia* M.B., on three cells as in *G. pallida* Stapf, or on 4 cells as in *G. nana* Bory et Chaub. This range of stoma types is in accordance with that which, according to METCALFE and CHALK (1950) is generally found in the *Caryophyllaceae*. Anatomically, *Gypsophila* leaves are quite normal, differing from one species to the other in the amount of mesophyll; the latter varies according to the thickness of the leaves. Most species have calcium oxalate crystals in the form of druses in the cells of the mesophyll, and in some species these crystals are found especially along the nerves, so e.g. in *G. pallida* Stapf.

### d. *On the Phyllotaxy of Gypsophila*

When noting for the first time the opposite leaves found in the family *Caryophyllaceae* we are inclined to think that they form pairs all along the stem, i.e. that they are arranged in the manner of the classical decussate phyllotaxy. As in most other plant families a spiral phyllotaxy is observed, several authors have tried to reduce the decussate phyllotaxy to a spiral one. However, they did this in two different ways, for one group tried to reduce it to a single spiral, the other one to two spirals.

MÜLLER (1866) was the first to point out a connection between the decussate phyllotaxy and the normal spiral phyllotaxy. By an anatomical study of apical buds he could prove that opposite leaves do not originate simultaneously, but one after the other. ROHRBACH



(1868) explained this by assuming that the leaves are arranged in a single spiral, and illustrated this interpretation by means of a diagram.

However, BENOIST (1933), who studied some abnormalities of the phyllotaxy in *Arenaria* and *Pycnophyllum*, concluded that there are in the family *Caryophyllaceae* two spirals running in the same direction and with an angle of  $180^\circ$  between them.

During my herbarium study of the genus *Gypsophila* and from some observations made on living material grown in the garden, I arrived at the following conclusions, viz.

1) The opposite leaves do not originate at the same time but one after the other. This is clearly seen when vegetative buds are dissected under a binocular microscope with high magnification. There is also a difference in size and especially in length between the two opposite leaves which sometimes may be quite considerable. Moreover, as has been mentioned before (p. 11), the opposite traces do not depart from the stele exactly at the same point, but one at a somewhat higher level than the other. The same applies to the opposite axial buds; they too are very seldom equal, and they show always a difference in the rate of development.

2) In *G. aretioides* Boiss. and *G. imbricata* Rupr. the internodes are very short and the pairs of leaves are accordingly very near to each other. In these species one can see clearly that the median planes of the consecutive leaf pairs are not perpendicular to each other, but form an angle of much less than  $90^\circ$ ; this angle is not constant, but amounts in these two species on the average to circ.  $30^\circ$ . In other species, it is sometimes exactly  $90^\circ$ , but not seldom much less.

3) Especially in the upper part of the stem, the leaves of the same pair are in many species not exactly opposite to each other, i.e. with an angle of  $180^\circ$  between them. In many species this is especially clear in the buds, but in *G. aretioides* and *G. imbricata* it is even clearly seen in the full-grown stem.

4) In *G. aretioides*, *G. repens* and *G. perfoliata* I noticed a few terminal flowers with one bract at their base instead of the usual two. In a terminal flower bud of *G. aretioides*, the angle between the bract and the first sepal appeared to be  $\frac{2}{5}$ th of a circle, that is to say that the bract was part of the same spiral as the calyx lobes. This was already noticed by SCHOUTE (1932b) in *G. acutifolia*.

5) In *G. spergulifolia* Griseb. it happens very often that in place of the usual two opposite leaves, a whorl of three or four leaves is present. In such cases the stem may have two leaves, three leaves or four leaves at the subsequent nodes. The abnormal nodes may differ in number from one to four. ROHRBACH (1868) noticed the same in *Silene stellata* (L.) Ait., and explained it by the shortening of an internode and the fusion of two alternate pairs of leaves. This might be accepted as an explanation of a whorl of 4 leaves, but the whorls of 3 leaves which Rohrbach noticed in *Silene linicola* Gmel. can not be explained in this way and were not explained by him.

In my opinion SCHOUTE (1932b) gave an acceptable explanation of the decussate phyllotaxy of the *Caryophyllaceae*. He agreed with MÜLLER (1866) and ROHRBACH (1868) with regard to the derivation of this type of phyllotaxy from a single spiral, and added that in each pair of leaves there is metatopy, that is to say an increase in the angle of divergence between two almost equally strong leaf primordia.

Taking this into account, the first of the above-mentioned conclusions is in accordance with the fact that the opposite leaves are formed according to their position on the spiral one after the other. That is to say that there is a lapse of time between the moment at which the first leaf begins its development and that at which the second leaf starts; this might be reflected also in the difference in size of the two opposite leaves and the difference in size of their axial buds. The second conclusion, i.e. that concerning the reduction of the angle between two successive pairs of leaves in *G. aretioides* and *G. imbricata*, becomes perhaps explainable when we take into consideration the effect exercised by the mountain climate on the growth of the stem and accordingly on the genetic spiral. In conditions like those in which these two dwarf species live, the stretching of the spiral is much less than it would be in normal climatological conditions with the result that the successive pairs of leaves are here nearer to each other than they usually are, and this might be the reason why the angle between them remains smaller. Our third conclusion is fully in accordance with the idea of the presence of a genetic spiral. The fourth conclusion is explainable when we assume that in the upper part of the stem the genetic spiral may return to its ideal form, which means that it produces but one leaf instead of two at the same time.

The fifth conclusion is another example of metatopy. When the internodes between three or four instead of two subsequent leaves remain undeveloped, these leaves divide the available space on the remaining node more or less equally. In this case the division of the available space is an example of metatopy.

One of the characters which A. BRAUN (1843) regarded as typical for *Saponaria* and absent in the other *Silenoideae* and especially in *Gypsophila*, was the alternate convolution of the leaves, which is well seen in *S. officinalis* L. In his monograph of the genus *Saponaria* SIMMLER (1910) pointed out that this character is not valid for the whole genus, and that especially the narrow-leaved species of *Saponaria* do not show it.

In *Gypsophila* I noticed that many leaves show a kind of asymmetry, one side being wider than the other one; in the bracts this asymmetry may even be more conspicuous. Moreover, the opposite leaves do not exactly face each other, but their tops deviate from the median plane. When we compare two opposite leaves, we find that they agree in their asymmetry and in the direction in which their tops deviate from the median plane. Let us say that one leaf has a wider right side, then the leaf opposite to it has also a wider right

side, and if one is deviating to the left, then the other is deviating also to the left, in other words, the one is the exact, not the reflected image of the other. The kind of asymmetry and the kind of deviation alternate with the alternation of the leaf pairs. Though the vernation is not very easily recognizable, it is a convolute one; this type of vernation can be explained as a result of an adaptation of the enlarging primordia to the space which is available in the bud (SCHOUTE, 1935b).

Considering these facts, we find that the difference between the vernation in *Gypsophila* and *Saponaria*, viz. valvate in the first and convolute in the second, is one of degree and not, as BRAUN (1843) assumed, a fundamental one. The convolute vernation is easily recognizable in some species, specially in wide-leaved ones, and less easily recognizable in others. This, moreover, is noticed not only in *Saponaria* and *Gypsophila*, but also in other genera of *Silenoideae*.

#### e. *The Inflorescence*

In *Gypsophila* as well as in most other *Caryophyllaceae*, the basic type of inflorescence is the dichasial cyme. The dichasium may fork up to six times, especially in annual species, where the inflorescence is very lax. In *Gypsophila muralis*, for example, nearly the whole plant with the exception of the very short basal part of the stem consists of the inflorescence. In many species, the dichasium is but twice forked, but in this case the ultimate branches are mostly trichotomous with the result that the inflorescence nevertheless bears a large number of flowers. In general one may say that of all *Silenoideae* *Gypsophila* is the most luxuriously flowering genus. In the section *Capituliformes* Williams the inflorescence looks like a capitulum, though morphologically it is a dichasial cyme. In some species the side branches of the dichasium do not develop to the same extent, or one of them is suppressed. This is seen in *G. sericea*, *G. violacea* and *G. serpylloides*.

The upper leaves change gradually into bracts; they decrease in size and become more or less hyaline. Typical *Gypsophila* bracts are deltoid and small hyaline scales, but in some species, e.g. in *G. achaia* Bornm., *G. sedifolia* Kurz, *G. nana* Bory et Chaub. and *G. cerastioides* Don, the bracts are foliaceous in shape and in texture. In a cross section the bracts, whether hyaline or foliaceous, appear to be similar in their anatomy to leaves. The edge of the bracts is often instructed with minute hairs, even in otherwise quite glabrous species like *G. struthium* L. and *G. collina* Stev.

The pedicel is mostly capillary, and after anthesis more or less recurved at the end. In some species, e.g. in *G. acantholimoides* Bornm., it is rigid and rather thick. In the section *Capituliformes* it is absent or shorter than the calyx. At its end the pedicel is mostly thicker, forming a small disc. Anatomically, the pedicel is similar to the stem. In general it is glabrous, even in species in which the stems are covered with glandular hairs.

f. *Remarks on the dichasial cymes found in Gypsophila*

The general idea about a dichasium is that it is composed of a middle flower and two more or less identical side branches, and that the plane of symmetry of the middle flower is perpendicular to the planes of symmetry of the two side branches. This is what is shown in the figure of *Viscaria vulgaris* given by EICHLER (1875) II, p. 106, fig. 41a. Eichler indicates in his diagram the opposite direction shown by the spiral of the calyx of the central flower and that of the calyx in one of the side flowers, but he does not discuss that phenomenon. In his detailed study of the symmetry patterns in *Stellaria media neglecta typica* MATZKE (1931) pointed out that an equal number of calyces with a clockwise and with a counterclockwise spiral are found here. He drew attention also to the fact that in two flowers differing in the direction of their spiral the planes of symmetry do not occupy the same position, but include with each other an angle of circ.  $120^\circ$ , not of  $180^\circ$  as Eichler had assumed in his diagram.

The difference of opinion between these two authors is the result of their different standpoints. Eichler takes the dichasium as an ideal flat organ with the pedicel of the middle flower and the axes of the side branches in the same plane. Matzke regards the flowers as independent units, and studies their symmetry without considering the place they occupy in the dichasium. This last point I would like to make clear here.

A dichasium in the genus *Gypsophila* (as well as in other genera of the *Caryophyllaceae*) is in its initial stage a four-axial structure, for it consists of the main axis, the pedicel of the central flower, and the axes of the two side branches. The centre of this structure is found in the point of branching. When we draw a diagram of this structure in a plane perpendicular to the main axis, the main axis is reduced to a point, the pedicel of the central flower and the axes of the side branches are reduced to lines. The lines representing the axes of the side branches lie in each others prolongation, and are therefore parts of a single line which passes through the main axis and is perpendicular to the line which represents the pedicel of the central flower. In an ideal dichasium the main axis is situated in the middle of the line representing the axes of the side branches (Fig. 1). The plane of symmetry of the central flower which passes through the middle of sepal no. 1, stands perpendicular to the side branches and is indicated in the diagram therefore by the line which represents the pedicel of this flower. The planes of symmetry of the central flowers of the side branches do not coincide with each other, but form an angle of circ.  $120^\circ$ . The lines representing these planes of symmetry cross each other in a point on the line which represents the pedicel of the central flower. The planes of symmetry of the central flower of the dichasium and those of the two central flowers of the side branches do not coincide, as indicated in Eichler's figure, but their transverse section forms a triangle. The central flowers of

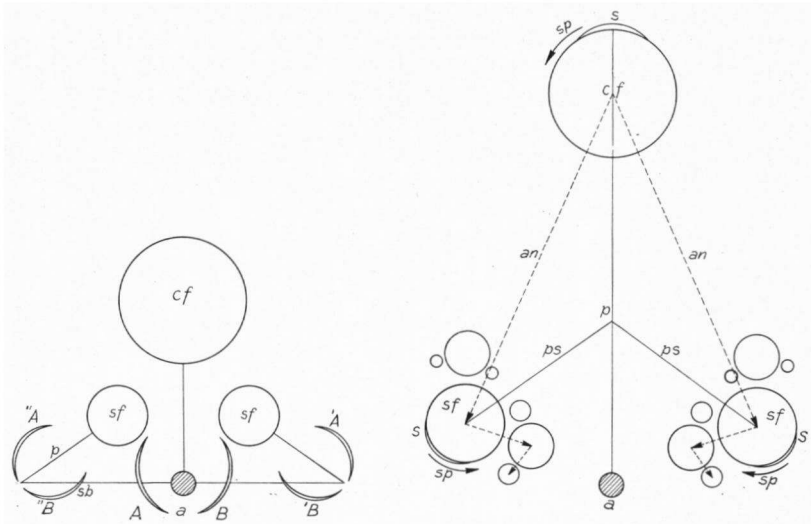


Fig. 1. Diagram of the dichasium in *Gypsophila*; A: first bract of the first fork; 'A: first bract of the side branch fork; "A: first bract of the fork of the other side branch; a: main axis; an: anthesis sequence direction; B: second bract of the first fork; cf: central flower of the dichasium; p: pedicel; ps: plane of symmetry; s: sepal no. 1; sf: central flower of the side branch; sp: spiral direction of the calyx segments

the side branches, moreover are situated between the central flower of the dichasium and the main axis of the dichasium.

In my opinion, this is the result of the way in which the dichasium is formed. The main axis first produces the central flowers with the two bracts of the lateral branches; here the limited amount of space plays an important role. The spiral on which the bracts are situated, passes always from the bract indicated by A to the bract indicated by B; this means that the space at that side of the main axis is limited, as the distance between the two bracts in the direction of the spiral is smaller than the distance on the other side; this explains why the flower develops at the side where more space is available, and not exactly as a continuation of the main axis; this means that the middle flower is laterally attached to the main axis. After that, each of the side branches of the dichasium begins to develop a central flower, and this takes place between the main axis and the central flower in the first fork. Here we find that these side flowers do not develop at the same time, but one after the other, just as did the bracts A and B in whose axil they are developing. Considering the bracts at the base of these side flowers, we find that in both branches bract A is always situated at the side of the central flower in the first fork of the dichasium and not at the side of the main axis, and this is in my opinion due to the fact that here more space is available, for the side towards the main axis, as mentioned before, is already occupied by the bracts in whose axil the side branches

are inserted. The result of this development is that the spirals of these side flowers are opposed, and this is what Matzke actually found in *Stellaria*, and what will be reported below for various *Gypsophila* species. Another fact to be mentioned here concerning the dichasial cyme of the *Caryophyllaceae* is that it is mostly that side flower which is nearer to the main axis which develops first. This explains why the dichasium shows a structure with symmetric and not with identical halves.

g. *Ontogeny of the flower in the genus Gypsophila*

In studying the ontogeny of the flower we notice first of all the development of the bracts at its base; they appear one after the other; since the days of Eichler they are called A and B. It is not only that bract A appears first, but its axillary bud too appears always before that of bract B. The primordium of the flower itself is in its youngest stages a globose mass of meristematic tissue. The sepals begin to appear in spiral sequence at the outer edge of this semi-globose meristematic mass, leaving in the centre a semi-globose rest. Later the episepalous stamens begin to appear (most probably in a spiral sequence), but clearly not as a continuation of the spiral formed by the calyx segments. Directly afterwards the epipetalous stamens appear, alternating with the episepalous ones (and may be as a continuation of the spiral formed by the latter). Then the central mass assumes an oblong shape, and begins to form the carpels; meanwhile at the base of the epipetalous stamens the petals make their appearance (Fig. 2).

The petals develop more quickly than the stamens, and shortly after their appearance they already exceed the stamens in length and cover them. The epipetalous stamens always remain behind the episepalous ones in development, and that is the reason why, in many *Gypsophila* species and in other *Silenoideae* as well, they remain shorter than those opposite the sepals. The sepals develop at first as separate units; later the connate part develops. This may be taken as a sign that the concrescence is a secondary character, and this is an argument in favour of the theory of an alsinoid origin of the *Silenoideae*.

After the development of the stamens two depressions appear at the upper surface of the central meristematic mass; they represent the primordia of two carpels with a dissepiment between. The dorsal part of the carpels develops more quickly than the lateral parts, and these parts develop more quickly than the dissepiment. Accordingly, the ovary obtains the shape of a cup partly divided into two locules and with the dorsal part of the carpels projecting. At the same time the peripheral parts of the sept develop more quickly than its median part. The dorsal part of the carpels grows gradually out to form the styles, and meanwhile the opening of the ovary is closed. Before the closing of the opening, but after the differentiation of the cylindrical primordia of the styles, the ovules begin to appear

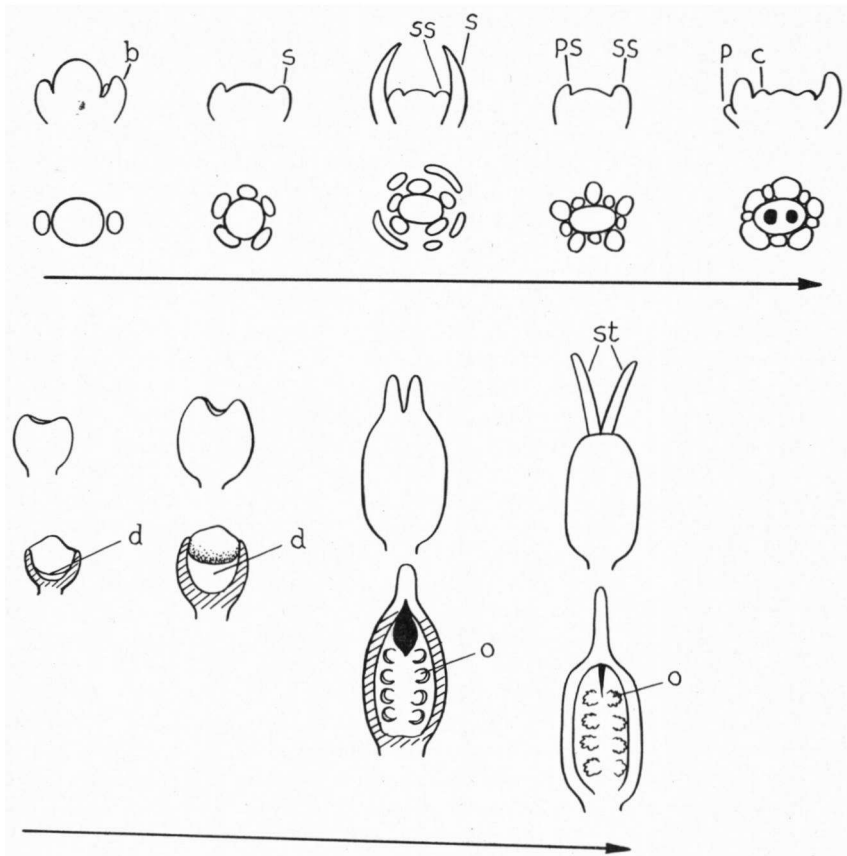


Fig. 2. Stages of the ontogeny of the flower members; *b*: bract; *c*: carpel; *d*: dissepiment; *o*: ovule; *p*: petal; *s*: sepal; *ss*: episepalous stamen; *ps*: epipetalous stamen; *st*: style; the arrow shows the sequence of the stages of development.

on the sides of the dissepiment starting at the top. When the ovary is completely closed, the integuments of the ovules grow out; this takes place in the same sequence. Gradually the part of the dissepiment which connects the ovules with the ovary wall dissolves leaving a central cord. The latter with its four longitudinal rows of ovules remains connected to the ovary roof by two fibers which represent the rest of the upper part of the sept. This last step takes place just before anthesis. The stigmas are the last part of the pistil to differentiate (Fig. 2).

#### h. The Calyx

The Calyx of *Gypsophila* is normally pentamerous, though some aberrant flowers may have four or six sepals, and gamosepalous with mostly five nerves alternating with broad hyaline intervals. In some

species, beside each main nerve two thin side nerves are present, and in this case they are connected with the main nerve by a network of fine nerves, forming a green band in the middle of every sepal.

The calyx proves to be a suitable object to test the validity of the classical theory of the alsinoid origin of the *Silenoideae*. When the calyx of *Gypsophila* is compared with that of other *Silenoideae*, it appears that it comes nearer to that of the *Alsinoideae* than that of any other genus. This is seen in three features: in its length, which is small in comparison to its width; in the lobes, which are long in comparison to the rest of the calyx; and in the width of the hyaline intervals. In reality, not all *Gypsophila* species show these features in the same degree, but this is no serious drawback, and this diversity is in itself interesting, because it gives some idea as to the possibilities of calyx evolution in the *Silenoideae*. In its diversity it sheds also some light on the relations between this genus and other genera of the same subfamily.

In *G. venusta* Fenzl, *G. fedtschenkoana* Šiškin, and *G. bucharica* Fedtsch. the calyx is long cylindrical with very small teeth, but the broad hyaline intervals are still typical, and the green bands, though with one main nerve and two side ones with a net between them, are very narrow. In *G. pilosa* Hudson, *G. hispida* Boiss. and *G. platyphylla* Boiss. the difference between the length of the calyx and its width is less pronounced than it is in the last-mentioned species, and mostly more than three nerves supply each segment forming in the upper part a wide net; these bands are separated from each other by very narrow hyaline intervals. In these two groups the *Gypsophila* calyx approaches that of *Saponaria* and of other silenoid genera. In the first group the resemblance rests on the long cylindrical form of the calyx, but in the second on an increase in the number of nerves in the green bands.

In other species the width of the hyaline intervals is strongly reduced to the benefit of the green bands. In *G. cerastioides* Don, *G. sericea* (Ser.) Krylov and *G. violacea* (Ledeb.) Fenzl this reduction of the hyaline bands is realized without any elongation of the calyx and without a more pronounced concrescence of the calyx segments.

In *G. antoninae* Šiškin and in *G. herniarioides* Boiss. the calyx is comparatively long and narrow with small teeth and approaches that of *Bolanthus* (Ser.) Reichenb. in texture and form, but it retains at the same time the hyaline intervals.

In *G. caricifolia* Boiss. and *G. graminifolia* Bark. the calyx shows the same leathery texture as is found in *Tunica*, *Dianthus* and *Uelezia*. At the same time no trace of a vein-net is present and in some calyces more than five parallel nerves appear at the base of the calyx. The *Gypsophila* calyx approaches in this way that of the last-mentioned genera.

In this connection one may say that in *Gypsophila* there is in the sepals a tendency to unite into a more or less cylindrical tube, the teeth which represent the free part being very small, but that this tendency is present in different degrees. At the same time there is a



tendency in the nerves to increase in number, the extra nerves forming either a net covering a large part of the calyx or appearing in the form of parallel side nerves. Each one of these trends has found its complete expression in various other genera of the *Silenoideae*, and on this account one may say that the *Gypsophila* calyx demonstrates to some extent the various evolutionary possibilities that are present in the silenoid calyx.

In many species of *Gypsophila* the calyx is glandular-hairy, and where the other parts too are hairy, the calyx is always more densely covered with hairs. Even among the species whose vegetative parts are quite glabrous, there are some with hairy calyces. The minute hairs that are sometimes found at the edge of the teeth, are more often present in glabrous species than in hairy ones.

In cross section the calyx is not different from the leaves except in the absence of chlorophyll in the hyaline intervals. The five main nerves depart from the stele before any of the other vascular strands supplying parts of the flower, and the side nerves usually spring from the petal strands, which depart either at the same level or at a somewhat higher one. In some cases the side nerves depart from the main nerve.

In the parenchyma tissue, in the green bands as well as in the hyaline intervals, crystals of calcium oxalate are present in large amounts. The number of these crystals, their size and their arrangement differ from one group of species to the other.

#### i. *Aestivation of Sepals*

During the taxonomic study of this genus, I noticed that some calyces were dextrorsely quincuncial, whereas others were sinistrorsely quincuncial. This difference was noticed in the same plant and even in the same dichasium. This induced me to study this point. Branchlets from living plants with their buds were fixed in alcohol and observed afterwards under a binocular microscope. Attention was focussed on two important points, viz. 1) the direction of the genetic spiral in every calyx, and 2) the types of genetic spiral that occur together in the same dichasium. The calyx aestivation showed with hardly any exception two main types: dextrorsely quincuncial and sinistrorsely quincuncial. The combination of these two types in one dichasium occurred in three forms, viz. 1.<sup>o</sup> symmetrical, that is to say in the calyx of the side flowers the direction of the genetic spiral is the same, and it is opposite to that found in the middle flower; 2.<sup>o</sup> zigzag that is to say that in the middle flower and in one of the side flowers the direction of the genetic spiral is the same, but that in the other side flower is opposite; and 3.<sup>o</sup> similar, that is to say that the direction of the genetic spiral in all three flowers is the same. The results of my observations are listed in table I.

TABLE I

No. species	calyx.		dichasium			total numbers	
	d. quin.	s. quin.	symmetr.	zigz.	simil.	dich.	fl.
42 fastigiata	34	29	2	18	7	27	63
43 fastigiata	28	43	13	16	2	31	71
131 repens	29	22	3	11	11	25	51
124 prostrata	27	37	—	13	12	25	64
79 perfoliata	31	23	—	25	—	25	54
129 tomentosa	35	29	2	21	2	25	64
29 elegans	9	14	2	8	—	10	23
— virgata	2	3	—	2	—	2	5
58 digenea	31	30	4	19	2	25	61
	226	230	26	133	36	195	456

No: garden number; d: dextrorsely; s: sintrorsely; quin: quincuncial; dich: dichasium; fl: flower.

This table shows clearly that the number of dextrorsely quincuncial calyces is nearly the same as that of the sintrorsely quincuncial ones; it appears moreover that the genus *Gypsophila* (so far as it was studied) has the two types of calyx on the same plant and more or less in the same number. About 68 % of the dichasia proved to be zigzag, 13 % symmetrical and 19 % similar. The similar dichasia can be explained by assuming that there is in the ramifications a tendency to retain the spiral of the stem. The zigzag ones can be explained by assuming that the direction of the spiral is determined, as described in our study of the dichasium of *Gypsophila*, by the amount of space that is available. For the symmetrical dichasia no explanation seems to be available: they are to be regarded as exceptions.

#### j. *The Corolla*

The corolla is in the genus *Gypsophila* the least variable part of the flower. The petals are generally 5 in number (in some aberrant flowers there may be 6 or 4), free and alternating with the sepals. They vary from cuneiform to linear and are mostly retuse at the apex. In a few species they are as long as the calyx, but mostly they are longer and spreading. There is no differentiation into limb and claw or only a slight indication of such a differentiation in the form of a slight contraction. Most *Gypsophila* species have white flowers, others are more or less pink, and a very few have white flowers with purple veins. *Gypsophila* flowers have no smell, that is recognizable to us, but at the base of the petals they possess nectar glands which attract insects by which pollination may be effected. Every petal has three nerves that meet at the top. These three nerves spring from a single strand that departs in the disc from the stele at the same level as the strands which enter the sepals or at a slightly higher one.

k. *Aestivation of the Corolla*

Very early in the history of botany it was noticed that the subfamily *Silenoideae* has a convolute corolla; BRAUN (1843) mentioned it in his treatment of the *Silenoideae*. Table II enumerates five hundred flowers collected from 8 *Gypsophila* species. In every species the flowers were taken from a single plant. The terms are taken from SCHOUTE (1935).

TABLE II

No. species	r.c.	l.c.	r.q.	l.q.	r.v.	l.v.	r.d.	l.d.	total
33 <i>elegans</i>	37	—	2	—	13	—	2	1	55
104 <i>silenooides</i>	25	—	—	—	—	—	—	—	25
124 <i>arrostii</i>	87	—	1	1	8	—	1	—	98
43 <i>fastigiata</i>	4	1	6	3	11	4	1	—	30
44 <i>fastigiata</i>	5	—	4	6	12	2	5	2	36
131 <i>repens</i>	79	1	5	2	2	2	5	1	97
87 <i>repens</i>	37	—	1	—	2	—	—	—	40
79 <i>perfoliata</i>	14	—	18	10	27	4	17	8	98
60 <i>paniculata</i>	25	—	—	—	4	—	—	—	29
	313	2	37	22	79	12	31	12	508

No: garden number; r: dextrorsely; l: sinistrorsely; c: convolute; q: quincuncial; v: vicinal; d: distal.

The table shows that the dextrorsely convolute aestivation is dominant in the different species of *Gypsophila*. It is found in about 62 % of the flowers. The sinistrorsely convolute aestivation is very rare and may be neglected as a distinct type of aestivation in this genus. Dextrorsely quincuncial, dextrorsely vicinal, and dextrorsely distal aestivations are all more frequent than the corresponding sinistrorsely forms of aestivation.

When we compare in our tables the aestivation of the calyx with that of the corolla, we find hardly any connection between them. And if the dextrorsely convolute corolla would have arisen out of a dextrorsely quincuncial one under the influence of the calyx segments, as SCHOUTE (1935) assumed, I can not see any way to explain how a dextrorsely convolute corolla might be surrounded by a sinistrorsely quincuncial calyx. Moreover, it seems hardly possible that the corolla, which is the last floral part to appear during the ontogeny of the flower, i.e. after the appearance of the stamens, would show in its parts a continuation of the spiral of the calyx segments, which appear first in the ontogeny.

l. *The Androecium*

Ten stamens arranged in two circles are always present, the outer circle comprising the episepalous ones. The filaments are always thicker at the base, tapering upwards and colourless. The anthers are oblong and fixed in the middle of the back to the top of the filament. They contain two mostly yellow, but sometimes purple or red thecae,

opening with two longitudinal slits on their inner side. In some *Gypsophila* species between the sepals and the base of the episepalous stamens nectar pockets are found.

The disc which is formed out of the adnate part of the petals and the stamen bases, is in *Gypsophila*, short and thick, while in other genera of the *Silenoideae* it is elongated in the form of an androphore.

#### m. *The Ovary*

A full-grown ovary of *Gypsophila* is globose or ovoid, unilocular with a central column on which 4 rows of ovules are inserted. In many species the placental column is connected with the roof of the ovary by 2 fibres which represent the rest of the upper part of the sept. In the ovary wall there are mostly 4 veins, one at the dorsal side of each carpel and the other two where the carpels meet, but a very few species, e.g. *G. capillaris* (Forsk.) Christ., have more than 4 veins, at least in the basal part of the ovary. The number of ovules varies from one species to the other. The way of attachment is always lateral and the ovules are campylotropous; they are arranged over each other in such a way that the micropyles point to one side, whereas the funicles are found on the other side with the back of the ovules turned to the middle part of the carpel. In some species the upper ovules have longer funicles than the lower ones.

There are mostly two styles, but in some aberrant flowers three styles are found. In the last case the relation between the number of styles and the number of ovary strands or the number of locules seen in the initial stages, e.g. before the dissepiment is dissolved, is disturbed, and the rule that every carpel has its own style, three vascular strands and two rows of ovules, is no longer adhered to. Though the styles in many species are spreading, they are in others incurved, and in this case they do not meet each other, but pass beside each other in a way that suggests a spiral twist. This spiral twist differs in direction in the flowers with dextrorsely quincuncial calyx from that in flowers with sinistrorsely quincuncial calyx, and it looks as a continuation of the spiral of the calyx. Moreover, the plane in which the styles are situated, is more or less perpendicular to that in which the bracts at the base of the flower are found.

#### n. *Placentation*

In the literature long discussions on the nature of the placentation in the family *Caryophyllaceae* are found.

ST. HILAIRE (1816), DUCHARTRE (1844), BRONGNIART (1844), SCHLEIDEN (1849) and PAYER (1857) regard the placenta in all Angiosperms as a continuation of the stem or of a branch of the latter, i.e. as an axial part. According to Payer, the margin of the carpel obtains its faculty to bear ovules from the fact that it is overlaid with an outgrowth of the branched floral axis.

DE CANDOLLE (1813), EICHLER (1875), VAN TIEGHEM (1868-69), and HENSLOW (1889) accepted the carpellary theory which was

proposed by the first-mentioned author. Van Tieghem insisted that the axis is a carpel-bearing structure, but that it is unable to produce ovules directly. He regarded the ovules as transformed lobes or teeth of the carpels.

BRAUN (1874) originally explained the axial placenta as the result of fused carpel margins, but later on he accepted the ovules as homologous to buds, and that means that the placenta must be axial.

Čelakovsky assumed that the axis may be involved in the development of the gynoecium, but regarded the ovules as born on appendages.

WARMING (1878) considered the ovule to be a sporangium covered with a foliar coat, but though that in certain cases the axis may produce a part of the gynoecium; the placenta, however, would always be an integral part of the carpel. SINNOTT and BAILEY (1914) and EAMES (1931) introduced a new theory about the nature of the primitive carpel. The carpel would be not homologous with an entire leaf but with a tri-lobed or five-lobed leaf.

A study of the ontogeny of the ovary in the genus *Gypsophila*, carried out in the species *G. elegans*, *G. perfoliata*, *G. fastigiata*, *G. tomentosa*, *G. repens*, *G. paniculata* and *G. arrostii*, led to the following results:

1) The dissepiment shows from its first appearance to its adult free central stage a bilateral symmetry in appearance as well as in anatomical structure. In its younger stages it is a wall of which the two sides are each directed towards a locule, and later in its free form it is connected with the top of the ovary by means of two fibers, which are situated in the plane between the two locules.

2) The development of the ovules begins at the top of the dissepiment and on both sides of the latter the ovules face the outer wall of the ovary.

3) The development of the outer part of the ovary wall and that of the dissepiment take place in similar directions, the dissepiment developing more quickly on the sides, while the ovary wall proper develops more quickly in the middle, so that no disjunction between the dissepiment and the ovary wall is to be recognized.

4) The upper ovules develop on the part of the dissepiment which overtops its middle part.

All of these facts point to a connection between the carpels and the placenta, although in the adult flowers this connection is obscured by the disappearance of the peripheral part of the dissepiment.

As the position of the vascular strands in the placental column is reversed, it is very difficult to distinguish the placental column from the main axis from which it arose, and this may be the reason why the central vascular strands are irregular in section, a BOQUET (1960) has shown in *Melandrium*. It is quite possible that some axial vascular strands continue their way in the centre of the placental column, but they will never supply ovules. Owing to the dichasial structure of the inflorescence the flower of the *Caryophyllaceae* is the continuation of the main axis; after producing the carpellary appendages this main

axis will cease to function, but it is not surprising that it does not disappear entirely. The vascular strands which VAN TIEGHEM (1871, 1898) and THOMSON (1942) found in the centre of the placental column of the *Melandrium* ovary are to be explained as rests of the vascular strands of the main axis. The alternation of the upper ovules with the lower ones which was observed in *Melandrium* is in my opinion the result of an incomplete incurvation in the upper part of the marginal zone (which forms the placental column) of the "carpels". What MOELIONO (1959) calls a separation between the "septs" and the placental column is a result of the fact that the "septs" disappear in the course of the development of the ovary; and the line of separation to which Moeliono points, is nothing but the boundary line of the tissue which will disintegrate later on.

#### o. Capsule and Seeds

The ripe fruit opens into two times as many valves as there are styles. The opening is not impeded by the presence of the calyx, because the latter is always shorter than the capsule. The seeds therefore have a good chance to spread.

The seeds have mostly the shape of a compressed snail. In some species they are more or less similar to *Saponaria* seeds, which means that they are more or less globose with a distinct hilum. Those of the section *Heterochroae* are more or less similar to those of *Acanthophyllum* in being slightly oblong. *Gypsophila* seeds are mostly black or brownish and covered with minute tubercles, but *G. tomentosa* has smooth shining seeds.

The embryo is peripheral and surrounds the endosperm, which occupies the centre of the seed.

### 3. CYTOLOGY

In recent years, cytological data have contributed greatly to the solution of difficult taxonomic problems. Whether at the level of species, genera or higher groups, cytological research has proved to be of fundamental importance to the delimitation and characterization of the taxa. To the present author it seems urgently necessary to combine orthodox taxonomic methods with cytological ones. Although in some cases neither the chromosome number nor other aspects of chromosome morphology could solve our taxonomic problems, in others they have proved to be a key to a better understanding of the relation between various taxonomic groups.

So far the family *Caryophyllaceae* has obtained but moderate attention from cytologists. Below, the present author will discuss two different ways of interpreting the cytological data that so far have been obtained in this family.

ROHWEDER, H. is one of the prominent workers in the cytology of *Caryophyllaceae*. He began his researches with the genus *Dianthus* (1934). Afterwards (1939) he extended his interest to the whole family. In (1943) he gave his final opinion on the results which he

had obtained. He studied the metaphase of the meiosis in 109 species, counting the chromosomes and measuring their size. The size of the nucleus was measured also. His conclusion was that for each species the ratio C/KL (chromosome size: nucleus size) is constant. By comparing this ratio in different species of the same genus as well as of different genera, he tried to establish relations between these taxa. When in two morphologically similar species nearly or exactly the same ratio C/KL is found, they are, according to Rohweder, really related, otherwise their morphological similarity would be a matter of convergence. His results in the genus *Dianthus* were for a great part in accordance with WILLIAMS' classification (1893) of this genus. One of the important results obtained by Rohweder was that the chromosome number 15 may be regarded as basic for the whole family *Caryophyllaceae*. Other chromosome numbers which are present in this family, as 14, 13, 12, 11, 10, 9 and 8, have been derived from the number 15. This happened, according to Rohweder, by the fusion of one or more pairs of archeotype chromosomes. The basic number (11) for example, would be composed of 4 fused pairs (= 8) plus 7 smaller single chromosomes, the total being 15. According to Rohweder, the fused pairs are two times as large as the supposed archeotype chromosomes which produced them. This was concluded by Rohweder by comparing small and large chromosomes occurring in the same cell. From the value of the ratio C/KL, the small size of the chromosomes, and the basic number (15), Rohweder concluded that *Dianthus* is a primitive genus and that it is quite probable that it is nearest to the prototype of the *Caryophyllaceae*. Other genera of the *Caryophyllaceae* were put in eight groups according to their basic chromosome number. The genus *Gypsophila* was not studied by Rohweder.

FAVARGER, C. (1946) made a special cytological study of the different genera of *Silenoideaea*. His attention was specially focussed on the structure of the nucleus in the interphase and in various stages of the mitosis. He recognized three different nuclear structures, viz. "euréticulé, réticulé et semiréticulé" with occasional transitions between them. The first two structures are characteristic for the tribe *Lychnidae* and the third for the tribe *Dianthae*. Moreover, Favarger counted the somatic chromosomes of 50 species belonging to 7 different genera of the *Silenoideaea*. According to the nuclear structure, the basic chromosome number and the size of chromosomes, Favarger constructed a phyllogenetic tree of the *Silenoideaea*. He considered a low basic chromosome number, large chromosomes, and a reticulate nuclear structure as primitive (tribe *Lychnidae*), and high basic chromosome numbers, small chromosomes, and a semi-reticulate structure as derived characters (tribe *Dianthae*). It is clear that Favarger's interpretation is nearly the opposite of that proposed by Rohweder.

The genus *Gypsophila* is very interesting in this regard. From the following list one can see that the basic chromosome number of this genus, so far as it is known, is 17 or 18. This number is not

present in any other genus of the *Silenoideae*. A cytological study of this genus may throw more light on the relation of *Gypsophila* with other genera. The genera *Bolanthus*, *Ankyropetalum*, *Acanthophyllum* and *Phryna* are also an interesting untouched field for cytological research.

As mentioned in the introduction to this work, the author had at his disposal living plants of several *Gypsophila* species grown in a botanical garden. Meiotic chromosome counts were made in all these species. The numbers found by him did not always agree with previously published counts from other authors; some also indicated different basic number. It is the present author's intention to check these data by making mitotic counts as well as by enlarging the scope of his studies. It is hoped that this work can be carried out in Syria where the climate is more favourable for growing *Gypsophila* and where some of the critical species (e.g. *G. pilosa*, *Ankyropetalum* and *Bolanthus*) occur in the wild.

<i>Gypsophila elegans</i> M. Bieb. ....	2n = (40)?	Furusato (1940)	Caucasus.
	2n = 34	Blackburn (1928).	
„ <i>altissima</i> L. ....	2n = 34	Favarger (1946)	E. Europe.
„ <i>aretioides</i> Boiss. ....	2n = 34-36	„ (1946)	Persia.
„ <i>fastigiata</i> L. ....	2n = 34	Sklinka (1950.a.)	C. Europe.
„ <i>muralis</i> L. ....	2n = 34	L. & L. (1942.b.)	Europe.
„ <i>repens</i> L. ....	2n = 34	Favarger (1946)	S. Europe.
„ <i>viscosa</i> Murr. ....	2n = 34	Blackburn (1931)	Syria.
„ <i>fastigiata</i> var. <i>arenaria</i>		(Waldst. & Kit.) Fries.	2n =
	34,	3n = 51	Favarger (1946) Europe.
„ <i>arrostii</i> Guss. ....	4n = 68	Blackburn (1931)	S. Europe.
„ <i>trichotoma</i> Wend. ....	4n = 68	„ (1931)	Caucasus, Turkestan.
„ <i>pacifica</i> Komar. ....	4n = 68	Favarger (1946)	Siberia.
„ <i>libanotica</i> Boiss. ....	2n = 36	„ (1946)	Lebanon.

#### 4. POLLEN MORPHOLOGY

In recent years pollen-morphological characters have often been used to furnish additional data for taxonomic valuation. In many cases they proved to be of importance for the delimitation of families, genera or species; their value varies, however, from one group to the other, as is the case with many other morphological characters.

The author tested the usefulness of pollen-morphological characters for the present revision. Preparations were made of pollen grains of 8 species of *Gypsophila*, of some species of *Saponaria* and *Tunica*, of all species of *Ankyropetalum* and of one of *Bolanthus* (*B. filicaulis*); this was done according to the acetolysis method. It was found that in all species studies by him they are very similar; morphologically similar species have quite or almost identical pollen-grains. The pattern of pollen-grain structure of *Gypsophila* (based on observations made on *G. cerastioides*, *G. elegans*, *G. fastigiata*, *G. fastigiata* var. *arenaria*, *G. muralis*, *G. pilulifera*, *G. pilosa*, *G. spaerocephala* and *G. viscosa*) may be summed up as follows:



Pollen-grains periporate, tectate, psilate, with granulate pore membrane; ectexine thinner towards the pore; number of pores 9–16, often 12; average size  $22 \mu$  (16–35.5); average diameter of annulus plus pore  $5.5 \mu$  (2.6–9); average thickness of the exine  $2.7 \mu$ .

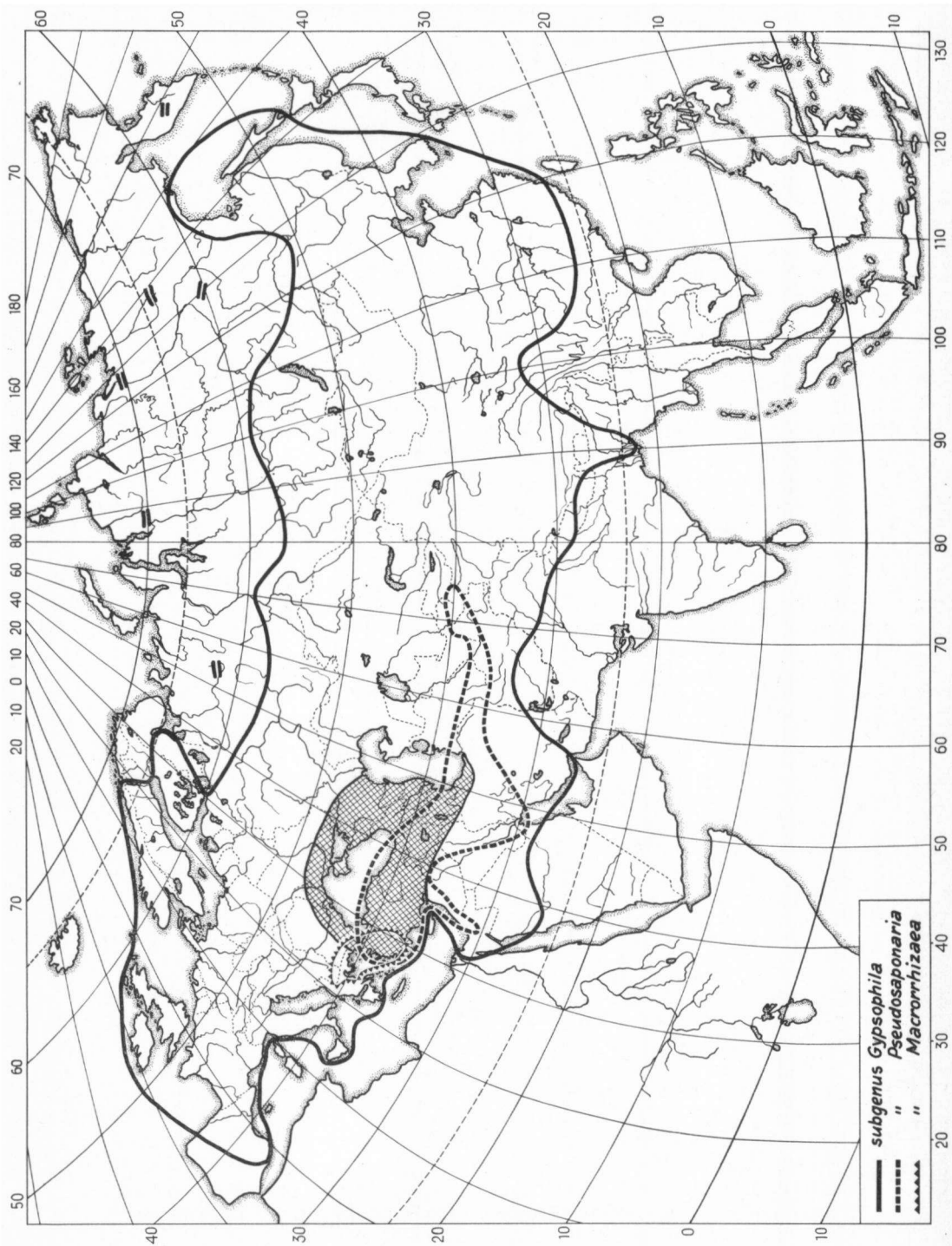
The pollen-grains of *Saponaria*, *Tunica*, *Ankyropetalum* and *Bolanthus* exhibit the same general pattern; the figures in the above description apply, however, only to the 8 species of *Gypsophila* of which the pollen was investigated by him.

## 5. GEOGRAPHY

*Gypsophila* is mainly an Eurasian genus. *G. paniculata* L., *G. elegans* M. Bieb. and *G. muralis* L. are the only species met occasionally in North America, but they have apparently been introduced, and are probably to be regarded as escapes from gardens. *G. capillaris* (Forsk.) Christ. is the only species that inhabits the N.E. corner of Africa (Egypt). *G. australis* (Schlecht.) Gray is the only species occurring in Australia.

*Gypsophila* inhabits the north temperate part of the old world. It is present from the Atlantic to the Pacific, and is found mainly between the latitudes of  $30^\circ$  and  $60^\circ$ . However, there are some exceptions, *G. sambukii* Šiškin inhabits the arctic part of Siberia, and *G. fastigiata* L. reaches in Scandinavia a latitude of  $69^\circ$ , whereas the subsection *Caespitosae* Boiss. passes in China to the south a latitude of  $30^\circ$ , *G. oldhamiana* Miq. reaching a latitude of  $25^\circ$ . In Nepal, Sikkim and E. Bengal *G. cerastioides* Don. even reaches a latitude of  $22^\circ$ . In south Iran, more than five species reach a latitude of  $25^\circ$ . In north Arabia, *G. viscosa* Murr., *G. antari* Post et Beauverd and *G. arabica* Bark. reach a latitude of  $25^\circ$ . The area limited above does not bear everywhere an equally dense population of *Gypsophila* species. In Atlantic Europe, for example, only *G. repens* L. and the subcosmopolitan *G. muralis* are present; in Scandinavia, only *G. fastigiata* and *G. muralis*; in Italy, only *G. arrostii* and *G. repens*. Most *Gypsophila* species are concentrated in a small part of the geographic area of the genus. This part of the area, which may rightly be called the main variation centre of the genus *Gypsophila*, includes the Black Sea region, Turkey, The Caucasus, north Iraq and north Iran. Of the 126 *Gypsophila* species 75 are represented here, that is to say three fifths of the total number. Moreover, 49 of them are restricted to this region; they are so-called endemics. Each of the three subgenera and all the eight sections of the genus are represented in this centre (Map 1).

Few other variation centres can be mentioned here. In north-east Spain there is a centre with five species belonging to two different sections. In the Balcan Peninsula there is one with five species representing two different sections belonging to two different subgenera. In south Tadzhikistan, north-east Afghanistan, north Pakistan and Kashmir there is another one with eight species representing three sections belonging to two different subgenera. In north China there is



Map. 1. Geographic distribution of the genus *Gypsophila* (*G. australis* and *G. muralis* are not included in this map). Cross-hatched lines: primary centre of species-concentration.

a centre with five species representing two sections of one subgenus, and in north Sinkiang and east Mongolia there is one with eight species representing three different sections. Compared with the main centre, the last-mentioned centres seem to be of secondary importance only.

Out of the 126 species which in this work are recognized in the genus *Gypsophila*, 71 species have a very limited geographic distribution and may be called endemics. The present author admits that a part of the geographic area occupied by the genus *Gypsophila* is not well-known floristically. It may appear later that some of the species in this work regarded as endemics have a wider distribution than we know at present. Twenty endemic species of *Gypsophila* are found in Turkey, twelve in the Caucasus, five in Transcaucasia and east Turkey, ten in Iran, two in Iraq, and two in west Iran and east Iraq. The rest of the endemic *Gypsophila* species are distributed more or less at random over the whole geographic area of the genus. From the data mentioned above one can easily conclude that the variation centre of *Gypsophila* is at the same time an endemism centre.

There are in *Gypsophila* two groups of "borderline" species that are closely related to *Saponaria*. The species of the first group (*G. tubulosa*, *G. confertifolia*, *G. muralis*, *G. macedonica* and *G. spathulifolia*) are all represented in the main variation centre of *Gypsophila*; those of the second group (*G. pilosa*, *G. hispida*, *G. nodiflora*, *G. platyphylla*, *G. boissieriana* and *G. venusta*), which are even closer to *Saponaria*, are restricted to that area, with the sole exception of the more widespread *G. pilosa*. Two species of the latter group (*G. hispida* and *G. venusta*) show also a connection with the genus *Ankyropetalum*, whose three species all occur in the same region (two of them occur exclusively here). Furthermore, *G. eriocalyx* and *G. lepidioides*, which in their fruits are close to *Acanthophyllum*, are restricted to this centre; the same is true for "*G.*" *minuartioides* and "*G.*" *jaubertiana*, transferred here to *Acanthophyllum*. Finally, the species connecting *Gypsophila* with *Bolanthus* (*G. antoninae*; *B. frankenioides* and *B. chelerioides*), and the monotypic genus *Phryna*, formerly included in *Gypsophila*, also occur there.

All these facts point to the conclusion that the genus *Gypsophila* originated in its present main variation centre, and most likely in that part of the area which covers the Caucasus, the Transcaucasian region and East Turkey.

## 6. ECOLOGY

*Gypsophila* is mainly a genus of the steppe. It inhabits for a great part the Irano-Turanian phytogeographic region which was described and delimited by ERG, A. (1931). This region is characterized by a very low amount of precipitation restricted to the winter and spring months, and by a long dry season. The summer is very hot and the winter very cold, with a temperature contrast between day and night

which is typical for a semi-desert. There are no forests, and most plants are either hemicytrophites or chamaephytes. The majority of the *Gypsophila* species inhabit dry slopes at middle or high elevations. Calcareous soil is in general preferred. Some species like *G. aretioides* Boiss., grow on bare calcareous rock or in crevices of the latter. *G. graminifolia* Bark. and *G. spergulifolia* Griseb. grow on serpentine. *G. sedifolia* Kurz. on gneiss. Very many species grow on rubble and stony hills.

*G. perfoliata* L. and *G. scorzonerifolia* Ser. grow on sandy soils, and prefer low and moist parts. *G. robusta* Grossh. is found on flooded river banks and *G. szovitsii* Fisch. & Mey. prefers a clay soil.

*G. confertifolia* Hub.—Morath and maybe *G. tubulosa* (Jaub. & Sp.) Boiss. play a part in the mediterranean maquis vegetation, *G. capillaris* (Forsk.) Christ. and *G. antari* Post et Beauverd inhabit sandy deserts. They may be classified as Saharo-Sindian elements.

*G. pilosa* Hudson and *G. muralis* L. grow in cultivated fields, and may be regarded as weeds. *G. muralis* L. may occur also as a ruderal plant.

These ecological data and those following the descriptions of the species were compiled from indications on herbarium labels. They are admittedly incomplete and often of a too general nature. It would be worth-while to collect more information about the habitats of all these taxa since this may shed some more light on their affinities ad delimitation.

## 7. USES

In general, *Gypsophila* is not a popular genus. Its small flowers, which vary in colour from pink to white and which have no smell, are not sufficiently attractive to justify its introduction in our gardens. Two *Gypsophila* species are, nevertheless used in some countries as ornamental plants, viz. *G. elegans* and *G. paniculata*. Some species of the subgenus *Pseudosaponaria* have pretty small flowers, and there is a chance that they too may be introduced in our gardens.

As we mentioned before (p. 10), the roots of *Gypsophila* contain a fairly good amount of saponin, which is used in pharmacy. *G. arrostii* and *G. acutifolia* are cultivated for the production of this substance. In Iran and Turkmenia, the roots of *G. bicolor* are used instead of soap; this use depends on the presence of saponin. The huge woody roots of *G. aretioides* are collected in Turkmenia to serve as fuel. The young stems of *G. oldhamiana* are used by the local population in China as a vegetable.

## B. TAXONOMIC PART

## 1. MATERIAL

The present work is based on the study of about 7000 herbarium sheets. However, in order to save space not all herbarium sheets studied by the writer are cited. When several collections from the same locality were available, only one or two are cited. Old collections of historical importance, widespread collections and collections provided with a number were generally given preference. Of two species (*G. briquetiana* Šiškin and *G. turkestanica* Šiškin) probably representing separate entities no material was seen by the author.

Some widespread species, e.g. *G. fastigiata*, *G. paniculata*, *G. muralis*, *G. altissima* and *G. pilosa*, were represented by very many collections, sometimes over 200. In these cases only some representative specimens, when possible from different parts of the area of the species, are enumerated. Sheets without exact geographic data are rarely cited, except when they represent authentic material or when no other collections were present from the general area.

The material was mainly borrowed from the following herbariums (abbreviations taken from Index Herbariorum):

- AA Alma-Ata, U.S.S.R.: Botanical Institute of the Academy of Sciences of Kazakh SSR.
- B Berlin-Dahlem, Germany: Botanisches Museum.
- BAG Baghdad, Iraq: National Herbarium of Iraq.
- BM London, Great Britain: British Museum of Natural History.
- BP Budapest, Hungary: Museum of Natural History, Department of Botany.
- BPU Budapest, Hungary: Institute of Systematic Botany and Plant Geography.
- BR Bruxelles, Belgium: Jardin Botanique de l'État.
- BRA Bratislava, Czechoslovakia: Slovenské Múzeum.
- BRNM Brno, Czechoslovakia: Botanické oddělení Zemského muzea.
- DD Dehra Dun, India: Forest Research Institute and Colleges.
- E Edinburgh, Great Britain: The Royal Botanical Gardens.
- FER Ferrara, Italy: Istituto ed Orto Botanico dell'Università.
- FI Firenze, Italy: Herbarium Universitatis Florentinae.
- G Geneva, Switzerland: Conservatoire et Jardin Botaniques.
- G-B. Geneva, Switzerland: Conservatoire, Boissier collection.
- GB Göteborg, Sweden: Göteborgs Botaniska Trädgård.
- GOET Goettingen, Germany: Systematisch-Geobotanisches Institut der Universität Goettingen.
- HUJ Jerusalem, Israel: Department of Botany, Hebrew University.
- JE Jena, Germany: Institut für spezielle Botanik und Herbarium Haussknecht.
- K Kew, Great Britain: The Herbarium, Royal Botanic Gardens.
- L Leiden, Netherlands: Rijksherbarium.
- LE Leningrad, U.S.S.R.: Herbarium of the Department of Systematics and Plant Geography of the Botanical Institute of the Academy of Sciences of the U.S.S.R.
- LINN London, Great Britain: The Linnean Society of London.

- M München, Germany: Botanische Staatssammlung.  
 MA Madrid, Spain: Instituto Botánico "Antonio José Cavanilles".  
 P Paris, France: Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie.  
 P-JU Paris, France: Muséum National d'Histoire Naturelle, Herbarium Jussieu.  
 P-LA Paris, France: Muséum National d'Histoire Naturelle, Herbarium Lamarck.  
 PR Praha, Czechoslovakia: Botanical Department of National Museum.  
 SLO Bratislava, Czechoslovakia: Botanický ústav Slovenskej University.  
 U Utrecht, Netherlands: Botanical Museum and Herbarium.  
 UPS Uppsala, Sweden: Institute of Systematical Botany, Botanical Gardens and Botanical Museum of the University of Uppsala.  
 W Wien, Austria: Naturhistorisches Museum.  
 WAG Wageningen, Netherlands: Laboratory for Plant Taxonomy and Plant Geography.  
 WU Wien, Austria: Botanisches Institut und Botanischer Garten der Universität Wien.

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## 2. DIAGNOSIS AND KEY TO THE GENERA OF THE DIANTHEAE

Tribe Diantheae Pax in Engler Pflanzenfam. 1, Aufl. 3., 1. B: 74 (1889); *Caryophyllaceae* Subdiv. *Diantheae* Reinchenbach, Handb. 298 (1837); *Sileneae* tribe *Diantheae* A. Braun, Flora 36: 377 (1843).

Styles two; fruit with one to many seeds, opening by teeth, valves or irregularly; calyx without commissural ribs; petals mostly dorsally contorted in bud, rarely imbricated.

### Key to the genera

- |   |                               |
|---|-------------------------------|
| 1. Seeds peltate, with a central hilum; embryo straight .....   | 2                             |
| Seeds reniform, with lateral hilum; embryo curved .....   | 4                             |
| 2. Calyx with 1-4 pairs of bracteoles at its base .....   | 3                             |
| Calyx without any bracteoles, with 15 ribs; teeth acerose ....  | <i>Uelezia</i> L.             |
| 3. Calyx with 35 or more ribs, cylindrical, with acute, seldom obtuse teeth; petals limb toothed or fringed, very rarely entire .....   | <i>Dianthus</i> L.            |
| Calyx either with 5 or with 15 ribs; flowers with a long pedicel; petals entire .....   | <i>Tunica</i> Scop.           |
| 4. Calyx with one to four pairs of bracteoles at base; in habit rather similar to <i>Tunica</i> .....   | <i>Phryna</i> Pax et Hoffmann |
| Calyx without any bracteoles at base .....  | 5                             |
| 5. Calyx with broad membranous intervals; petals without a coronal appendage or wings .....   | 6                             |
| Calyx without or with narrow membranous intervals, almost completely green; petals always with wings or a coronal appendage or both; styles stigmatose all along their inner side ..... | 8                             |

6. Leaves spiny, acerose or rigid ensiform; fruit with thick upper part and papery lower part, mostly not dehiscent with distinct teeth or valves ..... *Acanthophyllum* Fisch. & Meyer  
 Leaves very rarely spiny (*Gypsophila acantholimoides* and *G. pinifolia*); calyx mostly campanulate; seeds with a prominent radicle ..... 7
7. Petals deeply incised; capsule opening irregularly at base, the seeds remaining attached to the placenta after the shedding of the capsule wall and of the calyx ..... *Ankyropetalum* Fenzl  
 Petals never so; capsule dehiscent with four distinct valves ..... *Gypsophila* L.
8. Calyx ventricose, narrow in the upper part; capsule more or less distinctly two-locular at base; calyx ribs very prominent ..... *Uaccaria* Medic.  
 Calyx tubiform; capsule without septa at base ..... 9
9. Calyx less than 7 mm long; seeds with a distinctly projecting radicle; petals without coronal appendages ..... *Bolanthus* (Ser.) Reichenb.  
 Calyx longer than 7 mm; seeds reniform globose; petals mostly with coronal appendages ..... *Saponaria* L.

### 3. DIAGNOSIS AND SUBDIVISIONS OF THE GENUS GYPSOPHILA

*Gypsophila* Linné, K., Sp. Pl. ed. 1: p. 406 (1753) (8 sps. 1 *Arenaria*, 2 *Tunica*); Seringe in DC., Prod. 1: p. 351 (1842); Fenzl in Endlicher, Gen. Pl.: p. 972 (1836-40); Braun, A., Beitr. z. Festst. natürl. Gatt. u. d. Sileneen in Flora 36: p. 365 (1843); Ledebour, Fl. Ross. 1: (1842); Bentham, G., Notes on Caryophyllaea. in Jour. Linn. Soc. 6: p. 55 (1862); Boissier, Fl. Or. 1: p. 534 (1867); Williams, F. N., Revision of the specific forms of the genus *Gypsophila*. in Jour. of Bot. 27: p. 321 (1889); Pax, in Engler-Prantl, Nat. Pflanzenfam. 3b: p. 74 (1889); 2. Aufl. 16 C: p. 351 (1934); Šiškin, A. in Komar., Fl. U.S.S.R. 6: p. 731 (1936), and in Candollea 3: p. 473 (1928).

*Lanaria* Adams., Fam. 2: p. 255 (1763).

*Rokejeka* Forsk., Fl. Egypt. Arab. 90 (1775).

*Cypsophytum* Ehrh., Dietr. 4: 149 (1789).

*Asophila* Neck., Elem. 2: 162 (1790).

*Hagenia* Moench, C., Methodus Plantar. 61 (1794).

*Arrostia* Raf., Car. gen. 53 (1810).

*Gouffea* Robill. et Cast. ex DC., Fl. Fr. 6: 609 (1815).

*Banffya* Baumg., Enum. Stirp. Transs. 1: 385 (1816).

*Dichoglottis* Fisch. et Mey., Ind. Sem. Hort. Petr. 1: 25 (1835).

*Heterochroa* Bunge, in Ledebour, Fl. Alt. 2: 131 (1830).

*Petrorhagia* Link, Handb. 2: 235 (1831).

*Timaeosia* Klotsch, Bot. Ergeb. Wadem. Reise: 138, t. 33 (1862).

*Psammophila* Fourr., in Ann. Soc. Linn. Lyon. N. S. 16: 345 (1868).

Calyx campanulate or turbinate, rarely cylindrical, never tubiform and pentagonal or with thick projecting ribs, 5-toothed to pentafid, hyaline between the nerves, without commissural nerves along the tube, mostly with calcium oxalate druses in the parenchymatous tissue; petals 5, inserted on a cup-shaped disc, mostly

cuneate, without coronal appendages, claw never winged; androphore very short; stamens 10, exceptionally 5 (*G. spathulifolia*), introrse, filaments tapering from base to top; ovary globose or ovoid; styles 2, exceptionally 3, stigmatic surface terminal rarely along the upper third or all along the inner side of the styles; ovules 4–36, arranged in 4 series; capsule unilocular, globose, ovoid or oblong, deeply splitting into 4 valves; seeds auriculate, compressed on both sides, with prominent radicle, back convex, with tubercled testa, very rarely smooth, hilum marginal; embryo circular, with prominent radicle; endosperm central.

Annual or perennial herbs, rarely subshrubs, mostly glaucous, glabrous or glandular-hairy; leaves linear-subulate to spatulate, mostly lanceolate, subfleshy; flowers small and numerous, arranged in dichasial cymes, panicles consisting of cymes or capitula; bracts mostly scarious; bracteoles absent, flowers white to pink, sometimes with purple veins.

The name *Gypsophila* was given by Linné. *Gypso* (γυψος) = lime or plaster and *philos* (φίλος) = loving, because the representatives of this genus that were known to him prefer a limestone or chalky soil.

Types species: *Gypsophila repens* L.

#### Key to the subgenera

1. Calyx incised at least to one third, campanulate or turbinate ..... I. subgenus *Gypsophila*  
Calyx incised at the most to one third, more or less tubiform ..... 2
2. Plants higher than 30 cm; leaves at least 1 cm wide ..... III. subgenus *Pseudosaponaria*  
Plants less than 25 cm high; stem capillary; leaves less than 3 mm wide ..... II. subgenus *Macrorrhizaea*

#### I. Subgenus *Gypsophila*

Sect. *Eugypsophila* Boiss., Fl. Or. 1: 534 (1867); subgen. *Eugypsophila* Williams, Jour. of Bot. 27: 322 (1889); sect. *Rokejeka* (Forsk.) Graebn. in Ascher. et Graebn., Syn. 5, 2: 235 (1921); subgen. *Rokejeka* (Forsk.) Pax & Hoffm., in Engler, Pflanzenfam. 16.C: 352 (1934); Šiškin in Komar., Fl. U.S.S.R. 6: 738 (1936).

Calyx campanulate or turbinate, incised up to one third or deeper; stigmatic surface terminal, very rarely along the inner side of the upper part of the styles (*G. paniculata*, *G. × digenea*, *G. litwinowii*, *G. eriocalyx* and *G. lepidioides*); capsule globose or obovoid, exceptionally oblong (*G. spathulifolia*); seeds about 1 mm in diam., with prominent but not elongate radicle. Perennial, rarely annual herbs.

Type species: the same as that of the genus.

The subgenus *Cypsophila* is the largest of the three subgenera. The boundaries of its geographic distribution are the same as those of the genus. It includes 110 species, that is to say about  $\frac{7}{8}$ th of the



whole number; 57 of them are represented in the main variation centre of the genus.

#### Key to the sections

1. Plants cushion-shaped; stem less than 10 cm high; fls. at the most 7 ..... section 1. *Excipae* 2  
     Not so ..... 2
2. Leaves grass-like or spiny at the apex; in the latter case plants globose ..... section 3. *Ensifoliae*  
     Leaves not so ..... 3
3. Inflorescence capitate; pedicel absent or shorter than the calyx ..... section 5. *Capituliformes*  
     Inflorescence not so ..... 4
4. Inflorescence more or less corymbose; pedicel rigid, about twice as long as the calyx, very rarely in individual plants longer (*G. ellipticifolia*, *G. patrini*, *G. pacifica*, *G. tenuifolia*) ..... section 4. *Corymbosae*  
     Inflorescence lax, not corymbose ..... 5
5. Plants lower than 10 cm; internodes shorter than 1 cm; bracts foliaceous; hyaline intervals of the calyx very narrow or absent ..... section 7. *Heterochroa*  
     Other combination of characters ..... 6
6. Plants caespitose; stem up to 30 cm high, with at the most 20 fls. .... section 2. *Gypsophila*  
     Plants not caespitose; fls. mostly more than 20 ..... 7
7. Pedicel rigid, about 5 mm long; inflorescence paniculate, consisting of twice-forked dichasia ..... section 6. *Paniculaeformes*  
     Pedicel capillary, flexible, about 1 cm long; inflorescence lax, dichasial ..... section 8. *Dichoglottis*

#### 1. Sectio *Excipae* Williams, Jour. of Bot. 27: 332 (1889).

Cushion-shaped, stemless or with very low stems; less than 10 cm high; leaves small, fleshy; inflorescence with 1-7 fls. only; ovules 16-20.

Type species: *Gypsophila aretioides* Boiss.

Subsectio A. *Pulvinares* Boissier, Fl. Or. 1: 534 (1867); sect. *Pulvinares* (Boiss.) Pax in Engler, Pflanzenfam. 16. C: 353 (1934); Šiškin in Komar., Fl. U.S.S.R. 6: 744 (1936).

Dense cushion-shaped, glabrous; leaves very small, densely imbricated; pedicel shorter than calyx; calcium oxalate druses in the parenchyma of the calyx very small.

Type species: the same as that of the section.

Included species: *G. aretioides* Boiss. and *G. imbricata* Rupr..

This subsection inhabits the mountains of south Turkmenia, north Iran and Transcaucasia. Both species grow on bare calcareous rocks or in rock crevices. *G. imbricata* Rupr. is very restricted in its geographic distribution. It inhabits the mountains along the river Ardon in Transcaucasia. It would be of great interest to know whether the ecological conditions in which these two species live are the same or not, and whether any intermediate forms exist.

Subsectio **B. Crassae** Barkoudah subsect. nov.

Plantae glabrae, scabrae vel glanduloso-pubescentes, foliis parvis, pedicellis calyce aequilongis vel longioribus, petalis roseis instructae.

Type species: *G. saponarioides* Bornm. & Gauba.

Included species: *G. serpylloides* Boiss. & Heldr., *G. denophylla* Barkoudah, *G. rosea* Barkoudah.

All the species of this subsection are mountain plants. They are very restricted in their geographic distribution. Like the species of the last subsection they are found in rock crevices.

## 2. Sectio **Gypsophila**

Subsections *Trichophyllae* Williams, *Nanae* Williams and *Repentes* Williams ex part. in Jour. of Bot. 27: 323-324 (1889).

Caespitose low plants, up to 20 (30) cm high, with thin erect stems; inflorescence a small panicle consisting of twice forked dichasia; leaves linear; ovules 8-16.

Type species: the same as that of the subgenus.

Included species: *G. nana* Bory & Chaub., *G. achaia* Bornm., *G. repens* L., *G. spergulifolia* Griseb. and *G. davisii* Barkoudah.

This section inhabits the high mountains of W., C. and S. Europe (except Spain). Its species belong mainly to the central European flora. *G. davisii* Bark. however inhabits S. W. Turkey. *G. repens* L. is in this section the most widely distributed species and also the most variable one. The other three species inhabit the Balcan Peninsula.

*G. davisii* occupies a very interesting taxonomic and geographic position. It shows much similarity to *Tunica* sect. *Leptopleura*. The rigid stem, the leaves and the elongate-turbinate calyx with 15 nerves are in *G. davisii* nearly the same as in *Tunica* sect. *Leptopleura*. The other characters of *G. davisii* are nevertheless typical *Gypsophila* characters. As mentioned above, this species is geographically isolated from the other species of the sect. *Gypsophila*. *G. spergulifolia* Griseb. shows similarity to *G. curvifolia* Fenzl; this establishes a relation between the sect. *Gypsophila* and the sect. *Paniculaeformis* Williams subsect. *Suffruticosae* Boiss.

## 3. Sectio **Ensifoliae** Barkoudah sect. nov.

Plantae glabrae, caulibus erectis rigidis, foliis ensiformibus 3- 5-nervatis, inflorescentia paniculato-dichasial, pedicellis rigidis, staminibus ad basim glandulosis; ovulis 8-16 instructae.

Type species: *Gypsophila caricifolia* Boiss..

Included species: *G. acantholimoides* Bornm., and *G. graminifolia* Barkoudah.

The three species of this section are very close to each other in their geographic distribution. They have peculiar grass-like leaves. This can be understood from the name *graminifolia* which was given by Boissier to one of them. *G. acantholimoides* Bornm. looks very much like the species of the genus *Acanthophyllum* in its spiny leaves.

4. Sectio *Corymbosae* Barkoudah sect. nov.

Subsect. *Caespitosae* Williams, Jour. of Bot 27: 325 (1889) (exc. *G. virgata* Boiss. and *G. meyeri* Rupr.); subsect. *Altissimae* Williams, l.c., p. 325.

Plantae inflorescentiis plus minusve corymbosis, pedicellis rigidis, calyce campanulato vel turbinato, crystallorum globos plurimos in parenchymato continente, ovulis 8–24 instrcutae.

Type species: *Gypsophila fastigiata* L.

The section *Corymbosae* is very large in comparison with other sections of the genus *Gypsophila*. It inhabits a large continuous geographic area which extends from W. Europe to the Pacific shores of Asia.

Subsectio A. *Plumosae* Williams, Jour. of Bot. 27: 323 (1889), (exc. *G. caricifolia* Boiss.); subsect. *Trichotomae* Williams, l.c. p. 325, ex parte; series *Fastigiatæ* Šiškin in Komar., Fl. U.S.S.R. 6: 747 (1936).

Calyx 2–3.5 mm long; petals one and a half times as long as calyx, cuneate.

Type species: the same as that of the section.

Included species: *G. fastigiata* L., *G. altissima* L., *G. cephalotes* (Schrenk) Williams, *G. × digenea* Borb., *G. papillosa* Porta, *G. collina* Stev., *G. struthium* L., *G. iberica* Barkoudah.

This subsection inhabits Central and North Europe and extends in Asia between latitudes 45° and 60° to the Baikal Sea. Although the species of this subsection inhabit the region of pine forests, they never take a real part in pine forest vegetation. They are rarely met in very thin pine forests, and often along the margin of such forests. *G. struthium* and *G. iberica* inhabit the eastern half of the Iberian Peninsula. Their area is disjointed from the main geographic area of the subsection. Both these species are adapted to arid hills. *G. fastigiata* in the west and *G. altissima* in the east are the most widely distributed species of the subsection. The Black Sea region may be considered as the variation centre of this group.

Subsectio B. *Caespitosae* Boissier, Fl. Or. 1: 535 (1867); subdiv. *Grandiflorae* Fenzl in Ledeb., Fl. Ross. 1: 293 (1842), ex part.; subdiv. *Imbricariae* Fenzl in Ledeb., Fl. Ross. 1: 292 (1842); subsect. *Tatarophyllae* Williams, Jour. of Bot. 27: 324 (1889) (exc. *G. sedifolia* Kurz.); subsect. *Repentes* Williams l. c. p. 324 ex part.; series *Grandiflorae* (Fenzl) Šiškin in Komar. Fl. U.S.S.R. 6: 767 (1936); series *Imbricariae* (Fenzl) Šiškin, l.c. p. 762.

Calyx 3–5 mm long; petals oblong, one and a half to three times as long as the calyx.

Type species: *Gypsophila tenuifolia* M. Bieb.

Included species: *G. oldhamiana* Miq., *G. ellipticifolia* Barkoudah, *G. daurica* Turcz., *G. patrini* Ser., *G. pacifica* Komar., *G. preobrashenskyi* Czern., *G. licentiana* Hand.-Mazz., *G. sambukii* Šiškin, *G. capituliflora* Rupr., *G. mongolica* Barkoudah, *G. uralensis* Less., *G. brachypetala* Trautv., and *G. steupii* Šiškin.

This subsection is mainly Asaitic. Its geographic area extends from the Caucasus and Ural mountains to the Pacific shores of China and Manchuria. In North China, a special centre of this subsection is present. The part of this subsection which inhabits the Far East, is disjointed from the rest of it which inhabits the Altai, the Ural and the Caucasus. It is to be admitted here that the Chinese flora is not well-known. There are few herbarium collections from that region in Europe.

The geographic area of this subsection overlaps partly with that of the subsection *Plumosae*. Yet, the species of *Caespitosae* which overlap in their geographic distribution with those of the *Plumosae*, have their main geographic areas to the south of the overlapping area, while the main geographic areas of the overlapping species of *Plumosae* are to the north of the overlapping area. The *Caespitosae* inhabit mainly an area to the south-east of the geographic area of the *Plumosae*.

5. Sectio *Capituliformes* Williams, Jour. of Bot. 27: 323 (1889), subsect. *Lobatae* Williams, and subsect. *Dentatae* Williams, l.c.; sub-section *Capitatae* Boiss., Fl. Or. 1: 535 (1867), (exc. *G. caricifolia* Boiss); sect. *Capitatae* (Boiss.) Pax & Hoffm., in Engler Pflanzenfam. 16C: 353 (1934); Šiškin in Komar., Fl. U.S.S.R. 6: 745 (1936).

Inflorescence densely capitate; calyx turbinate with a large number of calcium oxalate druses in the parenchyma; petals cuneate, up to one and a half times as long as the calyx; ovules 4–12.

Type species: *G. sphaerocephala* Fenzl.

Included species: *G. pilulifera* Boiss., *G. syriaca* Šiškin, *G. olympica* Boiss., *G. transsylvanica* Spreng., *G. pinifolia* Boiss. & Hausskn., *G. lignosa* Lace & Hensl., *G. capitata* M. Bieb., *G. glomerata* Palles, *G. globulosa* Stev.

The section *Capituliformes* inhabits a continuous geographic area. Its species occur not far from each other, and they are clearly similar to each other. *G. lignosa* Lace & Hensl. is the only disjointed species. Turkey may be considered as a special variation centre of this section. Most of the species of the section *Capituliformes* inhabit high mountains and grow in calcareous rock crevices.

6. Sectio *Paniculaeformes* Williams, Jour. of Bot. 27: 324 (1889) (exc. *G. polyclada* Fenzl and *G. venusta* Fenzl); sect. *Eugysophila* Boiss., Fl. Or. 1: 534 (1867); Šiškin in Komar., Fl. U.S.S.R. 6: 747 (1936); sect. *Rokejeka* (Forsk) Graebn. in Ascher & Braebn., Syn 5,2: 235 (1921).

High, branched plants; inflorescence a rich panicle consisting of twice forked dichasia; pedicel longer than the calyx; calyx campanulate, 2–4 mm long, with calcium oxalate druses in the parenchyma of the hyaline parts; ovules 4–16.

Type species: *Gypsophila paniculata* L.

## Key to the subsections

1. Calyx hirsute; hairs eglandular ..... subsection E. *Coarctatae*  
Calyx either glabrous or with glandular-hairs ..... 2
2. Leaves 3- to 7-nervate, never scabrous; pedicel thick, rigid .....  
..... subsection C. *Trichotomae*  
Other combination of characters ..... 3
3. Stem woody at the base; leaves scabrous; pedicel thick, rigid; petal claw  
wider than the limb; ovules 4-8 ..... subsection D. *Suffruticosae*  
Leaves not so ..... 4
4. Leaves linear; inflorescence glandular-hairy; calyx 3-4 mm long .....  
..... subsection B. *Acutifoliae*  
Leaves linear to lanceolate; inflorescence mostly glabrous; calyx 2-2.5 mm  
long ..... subsection A. *Paniculatae*

Subsectio A. *Paniculatae* Boiss., Fl. Or. 1: 535 (1867), p. part.;  
subject. *Paniculatae* Williams, Jour. of Bot. 27: 325 (1889), p. part.;  
series *Parviflorae* Šiškin in Komar., Fl. U.S.S.R. 6: 748 (1936).

Leaves linear to lanceolate; inflorescence lax; pedicel filiform; calyx  
short campanulate 2-2.5 mm long.

Type species: the same as that of the section.

Included species: *G. bicolor* (Freyn & Sint.) Grossh., *G. arrostii*  
Guss., *G. simulatrix* Bornm. & Woron., *G. krascheninnikovii* Šiškin,  
*G. belorossica* Barkoudah.

This subsection inhabits a wide geographic area which extends  
from White Russia to north China. *G. paniculata* L. is the most  
widely distributed species. *G. belorossica* Barkoudah is similar to  
*G. fastigiata* L., and *G. krascheninnikovii* is similar to *G. altissima*  
L. This shows a relation between the sections *Corymbosae* and *Pan-  
iculæformes*.

Subsectio B. *Acutifoliae* (Šiškin) Barkoudah comb. nov.; series  
*Acutifoliae* Šiškin in Komar., Fl. U.S.S.R. 6: 757 (1936); subject.  
*Paniculatae* Boiss., Fl. Or. 1: 535 (1867), p. part.

Inflorescence densely paniculate; leaves linear; pedicel filiform;  
calyx campanulate, 3-4 mm long.

Type species: *G. acutifolia* Fisch.

Included species: *G. stevenii* Fisch., *G. scariosa* Tausch., *G. meyeri*  
Rupr., *G. albida* Šiškin.

This subsection inhabits a small geographic area, which includes  
the Black Sea region and the Caucasus. *G. scariosa* Tausch. inhabits  
the mountainous boundary zone between Italy and Switzerland.

Subsectio C. *Trichotomae* Williams, Jour. of Bot. 27: 325 (1889),  
p. part.; subject. *Paniculatae* Boiss., Fl. Or. 1: 535 (1867), p. part.;  
series *Trichotomae* Šiškin in Komar., Fl. U.S.S.R. 6: 759 (1936).

Plants with thick high stem; leaves wide, 3- to 7-nervate; inflore-  
scence lax paniculate; pedicel thick, rigid; calyx short campanulate,  
2.5-3.5 mm long.

Type species: *G. perfoliata* L.

Included species: *G. tomentosa* L., *G. oblanceolata* Barkoudah, *G. scorzoniferifolia* Ser., *G. robusta* Grossh., *G. × castellana* Pau.

*G. perfoliata* L. is the most widely distributed species in this subsection. It grows on sandy wet places and on solonjets meadows. On the other hand, *G. robusta* Grossh. shows a very special adaptation. It grows on flooded banks and in silty places. *G. oblanceolata* Bark. is adapted to salty marches. *G. tomentosa* L. is disjointed from the main geographic area of the subsection and adapted to arid hills.

Subsectio D. *Suffruticosae* Boissier, Fl. Or. 1: 535 (1867); sect. *Pauciovulatae* Williams, Jour. of Bot. 27: 322 (1889), p. part.; subsect. *Trichotomae* Williams, l.c. p. 325, p. part.; series *Virgatae* Šiškin in Komar., Fl. U.S.S.R. 6: 754 (1936).

Stem rigid, woody at the base; leaves small, mostly with a prominent net of nerves, scabrous; pedicel rigid thick, petal claw mostly broader than the limb.

Type species: *Gypsophila ruscifolia* Boiss.

Included species: *G. nabelekii* Šiškin, *G. curvifolia* Fenzl, *G. libanotica* Boiss., *G. pallida* Stapf, *G. aucherii* Boiss., *G. aulieatensis* Fedtschenk., *G. virgata* Boiss., *G. pallidifolia* Barkoudah, *G. transcaucasica* Barkoudah.

The subsection *Suffruticosae* inhabits a small continuous geographic area. A variation centre with a large number of species belonging to this subsection extends from the north-eastern corner of the Mediterranean to the eastern side of the Black Sea. *G. ruscifolia* is the most widely distributed species in this subsection. *G. aulieatensis* inhabits the district Aulieat in Kazakhstan, and is disjointed from the main geographic area of the subsection.

Subsectio E. *Coarctatae* Williams, Jour. of Bot. 27: 325 (1889); series *Eriocalycinae* Šiškin in Komar., Fl. U.S.S.R. 6: 757 (1936).

Suffruticose, puberulent to hirsute; hairs eglandular; inflorescence dense; calyx short-campanulate, with patent hairs, 2–2.5 mm long; stamens as long as the calyx or shorter; stigmatic surface along the inner side of the upper half of the styles; ovules 4–8.

Type species: *Gypsophila eriocalyx* Boiss.

Included species: *G. lepidioides* Boiss.

This subsection is endemic to Central Turkey. Both its species are adapted to gypsum hills in the steppe.

7. Sectio *Heterochroa* (Bunge) Fenzl in Endl., Gen. Pl. 10: 972 (1839); Šiškin in Komar., Fl. U.S.S.R. 6: 738 (1936); subsect. *Caudiculosae* Boiss., Fl. Or. 1: 534 (1867) p. part.; subsect. *Lepidophylloides* Williams, Jour. of Bot. 27: 323 (1889), p. part.; subsect. *Nanae* Williams, Jour. of Bot. 27: 324 (1889), p. part.; subsect. *Tatarophyllae* Williams, l.c. 324 p. part.

Low herbs; thin and flexible, hairy or papillose, internodes mostly shorter than 1 cm; leaves very small; bracts foliaceous; pedicel short; calyx either with narrow or without hyaline intervals and without calcium oxalate druses.

Type species: *Cypsophila microphylla* (Schrenk) Fenzl.

Included species: *G. cerastioides* D. Don, *G. desertorum* (Bunge) Fenzl, *G. violacea* (Ledeb.) Fenzl, *G. glandulosa* (Boiss.) Walp., *G. sericea* (Ser.) Krylov, *G. turkestanica* Šiškin, *G. sedifolia* Kurz, *G. antoninae* Šiškin, *G. herniarioides* Boiss.

The geographic area of this section is strongly disjointed. *G. glandulosa* inhabits the Caucasus; *G. antoninae* and *G. herniarioides* extend from the south-east shores of the Caspian Sea to north-east Afghanistan; *G. sedifolia* and *G. cerstioides* inhabit the southern side of the Himalayas; *G. sericea* and *G. desertorum* inhabit Turkestan and Mongolia, *G. violacea* inhabits the Pacific shores of Kamchatka, Okhotsk and Ussuria. The group is mainly mountainous, except *G. desertorum* which is a desert plant.

8. Sectio *Dichoglottis* (Fisch. & Mey.) Boissier, Fl. Or. 1: 536 (1867); subgen. *Dichoglottis* (Fisch. & Mey.) Pax et Hoffman in Engler, Pflanz. 16 C: 354 (1934); subsect. *Dichoglottides* Williams (of the sect. *Paniculaeformes*), Jour. of Bot. 27: 326 (1889).

Inflorescence lax, dichasial, more than twice forked; pedicel capillary, flexible, about 1 cm long or longer; calcium oxalate druses very small or absent.

Type species: *Gypsophila elegans* M. Bieb.

The section *Dichoglottis* inhabits a continuous comparatively small area. It is found mainly in the eastern part of the Irano-Turanian phytogeographic region, which was described by EIG (1931). Most of the species of this section are restricted in their geographic distribution. *G. elegans* is the most widely distributed one.

Subsectio A. *Drypidipetalae* Williams (of the sect. *Paniculaeformes*), Jour. of Bot. 27: 326 (1889).

Leaves linear; calyx lobes rounded; petals as long to one and half times as long as the calyx, cuneate.

Type species: *Gypsophila linearifolia* (Fisch. et Mey.) Boiss.

Included species: *G. melampoda* Bien., *G. heteropoda* Freyn et Sint, *G. pseudomelampoda* Gauba et Reching. f., *G. diffusa* Fisch. et Mey., *G. adenophora* Boiss. et Buhse, *G. mucronifolia* Reching. f., *G. szovitsii* Fisch. et Mey., *G. parva* Barkoudah, *G. spathulifolia* (Fisch. & Mey.) Fenzl.

This subsection inhabits a continuous geographic area which extends from east Turkmenia through north Iraq and north Iran to E. Turkey. It is noteworthy that most of the species of this subsection are restricted in their geographic distribution. *G. diffusa*, *G. heteropoda*, and *G. linearifolia* are the most widely distributed species. This subsection may be divided into two groups: the one has flat leaves and includes *G. heteropoda*, *G. melampoda*, *G. pseudomelampoda*, and *G. diffusa*; the other has fleshy leaves and includes *G. linearifolia*, *G. spathulifolia*, *G. szovitsii*, *G. parva*, and *G. mucronifolia*. *G. heteropoda* may be considered as intermediate between the two groups. East Turkey and Caucasus may be considered as a special centre of the subsection *Drypidipetalae*.

Subsection B. *Purpureae* Barkoudah subsect. nov.

Plantae glabrae, foliis latis, lanceolatis vel spatulatis, calyce late scarioso inter nervos, petalis calyce dimidio parte bis longioribus instructae.

Type species: the same as that of the section.

Series 1. *Elegantes* Šiškin in Komarov, Fl. U.S.S.R. 6: 736 (1936).

Leaves oblong to lanceolate; bracts triangular, scarios; petals emarginate to bilobed; ovary mostly short cylindrical; ovules 12–24.

Type species: the same as that of the section.

Included species: *G. elegans* M. Bieb., *G. iranica* Barkoudah, *G. silenoides* Rupr., *G. bitlisensis* Barkoudah, *G. viscosa* Murr..

The series *Elegantes* inhabits an area which extends from the Caucasus to Sinai south of Palestine. It is a continuous area with a special centre in the Caucasus. The most widely distributed species are *G. elegans* in the north and *G. viscosa* in the south.

Series 2. *Deserticolae* Barkoudah ser. nov.

Plantae glabrae foliis spatulatis, caulinis linearibus, bracteis plus minus foliaceis non scariosis, calycis lobis rotundatis, petalis cuneatis, ovario globoso, ovulis 4–16 instructae.

Type species: *Gypsophila capillaris* (Forsk.) C. Christ..

Included species: *G. antari* Post et Beauverd, *G. arabica* Barkoudah, *G. obconica* Barkoudah.

This series inhabits an area consisting of steppes and deserts and extending from north Egypt and north Arabia to north Iraq and north Iran. It is a continuous area in which the species of the series *Deserticolae* hardly overlap. *G. arabica* Bark. is the most widely distributed species among them. *G. capillaris* is perennial and adapted to sandy desert soil in north Egypt. *G. antari* is annual and adapted to sandy wet patches and wady banks. *G. arabica* is perennial and adapted to dry hills. *G. obconica* is annual and adapted to mountain slopes.

*G. obconica* shows much similarity to *G. bitlisensis* of the series *Elegantes*. The geographic areas of these species border on each other. This demonstrates a relation between the series *Elegantes* and *Deserticolae*.

Subsection C. *Longipetalae* Barkoudah subsect. nov.

Plantae perennes, caulibus erectis altis, foliis latis tri- vel quinque-nerviis, inflorescentia paniculato-dichasiali, bracteis triangularibus scariosis, petalis linearibus calyce dimidia parte usque ad ter longioribus, ovario globoso, ovulis 8 instructae.

Type species: *Gypsophila polyclada* Fenzl.

Included species: *G. xanthochlora* Reching. f., *G. persica* Barkoudah. *G. lurorum* Reching. f.

This subsection inhabits Iran and east Iraq. Its species grow on mountains and dry hills. *G. polyclada* is the most widely distributed species in the subsection.

*G. lurorum* is similar to the species of the subgenus *Pseudosaponaria*.



On the other hand, *G. xanthochlora* and *G. persica* are similar to *G. bitlisensis* of the subsection *Purpureae*.

II. Subgenus *Macrorrhizaea* (Boiss.) Pax et Hoffman in Engler, Pflanzenfam. 16 C: 354 (1934); based on section *Macrorrhizaea* Boiss., Fl. Or. 1: 536 (1867) (except *G. alsinoides* and *G. hispida*), Šiškin in Komar., Fl. U.S.S.R. 6: 774 (1936); subsection *Striatae* Williams (of the section *Macrorrhizaeae*), Jour. of Bot. 27: 327 (1889).

Calyx turbinate-tubiform or cylindrical, incised to one third or less, with small teeth; ovary long-ovoid; stigmatic surface all along the inner side of the styles (except in *G. confertifolia*); ovules 24–36 (12–14 in *G. confertifolia*), on a long placental column; capsule oblong, with numerous seeds; seeds about 0.5 mm in diam, with prominent elongate radicle; annual herbs (*G. macedonica* perennial).

Type species: *Gypsophila muralis* L.

Included species: *G. tubulosa* (Jaub. et Sp.) Boiss., *G. australis* (Schlecht.) Gray, *G. macedonica* Vandás, *G. confertifolia* Hub.-Morath.

This subgenus has some typical *Saponaria* characters, viz. the tubiform calyx, the stigmatic surface extending all along the styles, and the oblong four-toothed capsule. On the other hand, the hyaline bands between the ribs of the calyx, the cuneate petals without coronal appendages or claw wings, and the prominent radicle of the seeds are typical *Gypsophila* characters.

*G. muralis* is the most widely distributed species in this subgenus. It is nearly cosmopolitan. However, considering that its nearest relatives (*G. tubulosa* and *G. confertifolia*) are found in the west of Turkey and that its habitat is a ruderal one, one doubts whether this species is an indigenous European species; Europe might be a later extension of its geographic area. In North America *G. muralis* is no doubt, introduced. *G. australis* inhabits S.E. Australia and New Zealand.

III. Subgenus *Pseudosaponaria* Williams, Jour. of Bot. 27: 322 (1889); sect *Hagenia* (Moench) Boiss., Fl. Or. 1: 537 (1867); subgen. *Hagenia* (Moench) Pax & Hoffmann in Engler, Pflanzenfam. 2nd. ed. 16 C: 354 (1934).

Annual or perennial; inflorescence a dichasial panicle; bracts more or less foliaceous; calyx more or less tubiform, with wide hyaline intervals, green band with three anastomosing veins; petals linear, one and a half to three times as long as the calyx; ovules 4–20; capsule oblong, deep 4-valved; seeds about 1.5 mm in diam., with prominent radicle.

Type species: *Gypsophila pilosa* Hudson.

The subgenus *pseudosaponaria* inhabits a continuous geographic area which extends from the western shores of Turkey along the eastern shores of the Mediterranean to the Arabian Gulf, and from there to Issyk Kul and to the northern boundaries of Turkmenia. Central Turkey is clearly the special centre of this subgenus. *G. pilosa* is the most widely distributed species in this subgenus.

Series 1. *Hispidae* Šiškin, in Komar., Fl. U.S.S.R. 6: 770 (1936).

Plants hairy, at least in the upper part; calyx glandular-hairy, with long patent hairs; leaves wide, 3- or pluri-nervate; bracts acuminate, hairy; ovules 12–20, (very similar to *Saponaria*).

Type species: the same as that of the subgenus.

Included species: *G. hispida* Boiss., *G. fedtschenkoana* Šiškin, *G. platyphylla* Boiss., *G. villosa* Barkoudah, *G. boissieriana* Hausskn. & Bornm., *G. nodiflora* (Boiss.) Barkoudah.

This series inhabits a geographic area which extends from Turkey to Pamir-Alai in Turkestan. *G. pilosa* is the most widely distributed species.

Series 2. *Bucharicae* (Fedtsch.) Barkoudah comb. nov. sect. *Bucharicae* Fedtschenk., Act. Hort. Petrop. 32: 7 (1916), and in Komar., Fl. U.S.S.R. 6: 771 (1936).

Roots tuberous; stem completely glabrous, forked from base to top; calyx long tubiform, with narrow green bands and wide hyaline intervals; petals linear, two times as long as the calyx; stamens with thick glandular base; ovules 8–12.

Type species: *Gypsophila bucharica* Fedtschenko.

Included species: *G. intricata* Franch.

Both species of the subsection *Bucharicae* are endemic to Tadzhikistan in U.S.S.R. They are very similar to the species of the last series.

Series 3. *Venustae* Barkoudah series nov.

Plantae glabrae radicibus non tuberosis, foliis lancealatis, petalis lineari-cuneatis, ovulis 8–12 instructae.

Type species: *Gypsophila venusta* Fenzl.

4. KEY TO THE GYPSOPHILA SPECIES

- 1. Annual ..... 2
- Biennial or perennial ..... 21
- 2. Glabrous, sometimes viscous, never hairy ..... 3
- More or less hairy; hairs eglandular or glandular ..... 12
- 3. Thin capillary stem, branched from base; leaves linear not more than 2.5 mm wide ..... 4
- Stem not so; leaves wider ..... 6
- 4. Stem 5–20 cm high; bracts foliaceous ..... 5
- Stem 30–50 cm high; bracts scarious; petals shallowly emarginate .... 101. *G. iranica* Bark.
- 5. Calyx 3–4 mm long; styles stigmatose all along their inner side; leaves ciliate at base ..... 112. *G. muralis* L.
- Calyx 2 mm long; stigma terminal; leaves without hairs ..... 90. *G. heteropoda* F. & S.
- 6. Upper internodes of the stem viscous ..... 7
- Internodes never viscous ..... 8
- 7. Leaves lanceolate, sessile, fls. pink; seeds with acute tubercles ..... 103. *G. viscosa* Murr.
- Leaves linear-lanceolate; fls. white; seeds with flat tubercles .....

- ..... 90. *G. heteropoda* F. & S.
- 8. Leaves acute; calyx with distinct hyaline bands between the nerves; petals 1.5–2 times as long as the calyx ..... 10
- Leaves obtuse; calyx with very narrow hyaline bands; petals as long as the calyx ..... 9
- 9. Leaves linear, 1–3.5 cm long; bracts triangular scarious; petals shallowly bilobed or dentate ..... 90. *G. heteropoda* F. & S.
- Leaves more or less spatulate, less than 1.5 cm long; bracts foliaceous; petals with broad claw and round apex .... 89. *G. melampoda* Bien.
- 10. Leaves spatulate, with narrow base; stem branched from base; petals cuneate ..... 11
- Leaves oblong-lanceolate; stem branched in the upper half only; petals oblong, emarginate ..... 99. *G. elegans* M. Bieb.
- 11. Bracts linear, foliaceous; petals cuneate, purple-veined; pedicel capillary, flexible ..... 106. *G. antari* Post & Beauverd
- Bracts triangular, scarious; pedicel rigid; petals truncate to shallowly emarginate, white ..... 102. *G. bitlisensis* Bark.
- 12. Leaves lanceolate, 3- to 5-nervate; pedicel glabrous ..... 120. *G. pilosa* Hudson
- Leaves linear or linear-spatulate, not wider than 7 mm ..... 13
- 13. Leaves ca. 1 mm wide, with thick midrib; calyx tubiform, with long glandular hairs ..... 14
- Leaves otherwise; calyx never with long glandular hairs ..... 16
- 14. Pedicel nearly absent; calyx teeth subulate, at the apex obtuse ..... 116. *G. confertifolia* Hub.-Mor.
- Pedicel at least as long as the calyx; calyx teeth semi-orbicular with scarious border ..... 15
- 15. Pedicel with long glandular hairs; plants from Australia ..... 115. *G. australis* (Schlecht.) Gray
- Pedicel puberulent; plants from Turkey or Syria ..... 114. *G. tubulosa* (Jaub. & Sp.) Boiss.
- 16. Upper bracts linear, foliaceous; ovary globose ..... 18
- Upper bracts triangular, scarious; ovary ovoid ..... 17
- 17. Bracts and calyx glandular hairy; calyx 2–2.5 mm long, with subacute teeth ..... 90. *G. heteropoda* F. & S. subsp. *minutiflora* Bark.
- Bracts and calyx glabrous; calyx 1.5–2 mm long, with rounded lobes ..... 96. *G. parva* Bark.
- 18. The whole plant glandular pubescent; calyx more or less tubiform .... 19
- Calyx glabrous, wide campanulate ..... 20
- 19. Leaves linear; calyx 2–2.5 mm long, pubescent ..... 97. *G. linearifolia* (Fisch. & Mey.) Boiss.
- Leaves spatulate; calyx 5–7 mm long, hirsute ..... 98. *G. spathulifolia* (Fisch. & Mey.) Fenzl
- 20. Calyx lobes apiculate; leaves less than 2 mm broad; calyx less than 2 mm long ..... 95. *G. szovitsii* Fisch. & Mey.
- Calyx lobes semi-orbicular; basal leaves lanceolate, 5 mm broad; calyx 2.5–3 mm long ..... 92. *G. diffusa* Fisch. & Mey.
- 21. Dense cushion-shaped, nearly stemless plants with very small imbricated (1–2 mm long) leaves ..... 22

Not so .....	23
22. Stems with 1-2 fls.; calyx teeth semi-orbicular; petals cuneate; flowers up to 3.5 mm long .....	1. <i>G. aretioides</i> Boiss.
Stems with 1-4 fls.; calyx teeth acute; petals shallowly emarginate; flowers 5-6 mm long .....	2. <i>G. imbricata</i> Rupr.
23. Leaves sclerified, rigid, more or less spiny at the apex .....	24
Leaves not so .....	25
24. Leaves 3-8 cm long; inflorescence capitate .....	44. <i>G. pinifolia</i> Boiss. & Hausskn.
Leaves less than 2 cm long; inflorescence lax, dichasial .....	13. <i>G. acantholimoides</i> Bornm.
25. Inflorescence densely capitate; pedicel very short or absent; bracts scarious .....	26
Inflorescence either lax or capitate, but then bracts never scarious; pedicel present .....	35
26. Basal leaves at least 3 mm wide; calyx glabrous; flowers white .....	27
Basal leaves less than 2 mm wide, mostly triquetrous .....	28
27. Several of the upper internodes of the stem glandular-hairy; bracts and calyx lobes entire, seeds with acute tubercles .....	46. <i>G. glomerata</i> Pallas
Only the uppermost internode of the stem glandular-viscous; bracts and calyx teeth erose; seeds with obtuse tubercles ..	47. <i>G. globulosa</i> Stev.
28. Glabrous; calyx and pedicel without any hairs; leaves triquetrous; plants from the Caucasus .....	43. <i>G. capitata</i> M. Bieb.
Glandular-hairy either ein the upper part of the stem or on the pedicel or calyx .....	29
29. Less than 40 cm high .....	30
More than 40 cm high .....	33
30. Leaves terete; calyx teeth with incurved margin; bracts apiculate; plants from Afghanistan and Baluchistan ....	45. <i>G. lignosa</i> Hemsl. & Lace
Leaves triquetrous or flat .....	31
31. Flower heads terminal and axial; petal claw wider than the limb, pink .....	40. <i>G. syriaca</i> Šiškin
Flower heads solitary, terminal; petals cuneate .....	32
32. Leaves flat, 2-5 cm long, with wide scarious base; calyx glabrous; plants from the Carpaths .....	42. <i>G. transylvanica</i> Spreng.
Leaves triquetrous, ca. 1 cm long; calyx glandular-hairy .....	41. <i>G. olympica</i> Boiss.
33. Calyx 2-3 mm long, with ovate obtuse teeth; ovules 12; plants from Spain .....	22. <i>G. iberica</i> Bark.
Calyx lobes apiculate or acuminate; plants from Turkey .....	34
34. Flower heads less than 1 cm in diam.; calyx ca. 2 mm long; petals shallowly emarginate or dentate ....	39. <i>G. pilulifera</i> Boiss. & Heldr.
Flower heads at least 1 cm in diam.; calyx at least 3 mm long; petals with rounded apex .....	38. <i>G. sphaerocephala</i> Fenzl
35. Stem thin, prostrate, sometimes forming mats, never erect and rigid; bracts mostly foliaceous .....	36
Stems more or less erect, rigid; bracts scarious .....	48
36. More or less hairy; inflorescence more or less capitate; pedicel shorter than the calyx; leaves less than 2 cm long .....	37
Inflorescence lax, or flowers solitary .....	39

37. Hairs eglandular; calyx cleft to the middle, without hyaline bands; petals oblanceolate, white ..... 86. *G. sedifolia* Kurz.  
Hairs glandular; calyx with hyaline bands between the veins, toothed up to one third; petals linear-cuneate ..... 38
38. Leaves linear, acute, 5–10 mm long; fls. purple-pink; ovules 8–12 ..... 88. *G. antoninae* Siškin  
Leaves oblong-spatulate, 4–8 mm long, obtuse; petals white with purple veins; ovules 4–12 ..... 87. *G. herniarioides* Boiss.
39. Leaves spatulate, hirsute, with eglandular hairs; plants from the Himalayas ..... 78. *G. cerastioides* D. Don  
Leaves linear or subulate, less than 1 cm long, glabrous or glandular-hairy ..... 40
40. Leaves more or less subulate, fleshy, less than 1 mm wide; calyx campanulate; with lobes shorter than the connate part ..... 41  
Leaves flat, more than 1 mm wide; calyx wide campanulate, cleft to the middle or deeper ..... 43
41. Glabrous; fls. solitary; petals linear-cuneate ..... 3. *G. serpylloides* Boiss. & Heldr.  
Calyx and pedicel glandular-hairy; petals oblanceolate, broad ..... 42
42. Stem glandular-hairy in the upper part only; fls. axillary and terminal; leaves obtuse, glabrous ..... 4. *G. saponarioides* Bornm. & Gauba  
Stem glandular-hairy all along; fls. only at the end of the stem; leaves pointed, glandular-hairy ..... 5. *G. adenophylla* Bark.
43. Glabrous; calyx 2.5–3 mm long, with ovate rounded teeth ..... 85. *G. turkestanika* Siškin  
Hairy or papillose; calyx 3–5 mm long ..... 44
44. Leaves linear, acute, mostly falcate; calyx 3–3.5 mm long; seeds with curved excrescences ..... 80. *G. desertorum* (Bge.) Fenzl  
Leaves lanceolate or elliptic, small ..... 45
45. Epidermis papillose, not hairy; calyx 3–3.5 mm long ..... 84. *G. microphylla* (Schrenk) Fenzl  
Glandular-hairy; calyx 4–5 mm long ..... 46
46. Leaves lanceolate, sessile semi-amplexicaul; petals with rounded apex, violet ..... 81. *G. violacea* (Ledeb.) Fenzl  
Leaves elliptic, narrowed at base; petals truncate to shallowly emarginate ..... 47
47. Fls. pink; pedicel up to 5 mm long; ovules ca. 20, seeds with acute tubercles ..... 82. *G. glandulosa* (Boiss.) Walp.  
Fls. white, lilac on the under-side; pedicel up to 1.5 cm long; ovules ca. 16; seeds with flat tubercles ..... 83. *G. sericea* (Ser.) Krylov
48. Leaves 3- or pluri-nervate, more than 5 mm wide ..... 49  
Leaves with but one distinct nerve and less than 1 cm wide; if not, then the inflorescence never a lax panicle ..... 74
49. Glabrous or sometimes viscous, but never distinctly hairy ..... 50  
More or less hairy ..... 58
50. Leaves more or less cordate, amplexicaul, at most twice as long as wide ..... 51  
Leaves not so ..... 52
51. Leaves with scabrous border, leathery, with a prominent net of nerves; petals one and a half times as long as the calyx; plants from the Near East ..... 69. *G. ruscifolia* Boiss.

- Leaves smooth; petals twice as long as the calyx; plants from the Far East ..... 28. *G. pacifica* Komar. 53
52. Calyx tubiform, more than 3.5 mm long ..... 53  
Calyx campanulate or wide campanulate, less than 4 mm long ..... 54
53. Stem 20–40 cm high, branched from base to top, branches patent; calyx 6–9 mm long ..... 124. *G. bucharica* Fedtsch.  
Stem 40–70 cm high; calyx 3.5–5 mm long ..... 126. *G. venusta* Fenzl
54. Calyx short campanulate, 2–2.5 mm long; petals one and a half times as long as the calyx ..... 55  
Calyx campanulate, 3–3.5 mm long; petals twice as long as the calyx; inflorescence corymbose ..... 24. *G. oldhamiana* Miq.
55. Stem more or less viscous; leaves narrowed at base, less than 5 cm long 56  
Not viscous; leaves lanceolate, mostly longer than 4 cm ..... 57
56. Pedicel not more than 4 mm long; calyx lobes oblong, obtuse .....  
..... 51. *G. simulatrix* Bornm. & Woronow  
Pedicel 0.5–2.5 cm long; calyx lobes triangular, acute .....  
..... 108. *G. xanthochlora* Rechinger f.
57. Inflorescence subcorymbose; pedicel ca. 3 mm long; calyx lobes subcordate; plants from the Near East .. 49. *G. bicolor* (F. & S.) Grossh.  
Inflorescence with patent branches; calyx teeth ovate; pedicel ca. 5 mm long; plants from Siberia or Europe ..... 48. *G. paniculata* L.
58. Hairy in the lower part or all over ..... 59  
Hairy either in the upper part only, or above the nodes ..... 65
59. Hairs patent eglandular; pedicel shorter than the calyx .....  
..... 78. *G. lepidioides* Boiss.  
Hairs either very short or glandular ..... 60
60. Pedicel, calyx and the underside of the bracts glandular-hairy ..... 61  
Pedicel and calyx glabrous ..... 63
61. Calyx 2.5–3.5 mm long; leaves spatulate .. 111. *G. lurorum* Rechinger f.  
Calyx 4–6 mm long, leaves not spatulate ..... 62
62. Leaves cordate, amplexicaul; pedicel with long patent hairs; calyx campanulate ..... 118. *G. fedtschenkoana* Šiškin  
Leaves ovate to lanceolate; pedicel shortly glandular-pubescent; calyx tubiform ..... 121. *G. platyphylla* Boiss.
63. Calyx 2.5–3 mm long; bracts and calyx teeth ciliate; seeds with acute tubercles on the back; the whole plant glaucous 63. *G. robusta* Grossh.  
Calyx not more than 2.5 mm long with ovate and obtuse lobes; seeds with very small tubercles; the whole plant yellow-green ..... 64
64. In the upper part glabrous; petals shallowly emarginate; seeds with small tubercles, plants from E. Europe or Asia ... 59. *G. perfoliata* L.  
Glandular-pubescent all over; petals with rounded apex; seeds smooth; plants from Spain ..... 61. *G. tomentosa* L.
65. Pedicel and calyx hairy ..... 66  
Pedicel and calyx glabrous ..... 72
66. Calyx 4–8 mm long ..... 67  
Calyx 2.5–3.5 mm long ..... 70
67. Flowers in axillary clusters sessile .... 123. *G. nodiflora* (Boiss.) Bark.  
Flowers in lax dichasial inflorescences; pedicel long ..... 68
68. Calyx campanulate-tubiform, 4–7 mm long; petals with broad limb,

- shallowly trilobed to emarginate ..... 117. *G. hispida* Boiss.  
 Calyx tubiform-cylindrical, 5–8 mm long; petals linear cuneate, with a truncate to rounded apex ..... 69
69. Glandular-pubescent; basal leaves ovate; petals 1.5–2 times as long as the calyx ..... 122. *G. boissieriana* Hausskn. & Bornm.  
 Glandular-villose; basal leaves lanceolate; petals at the most one and a half times as long as the calyx ..... 119. *G. villosa* Bark.
70. Leaves oblong to oblanceolate, obtuse; calyx densely glandular-pubescent; stamens with nectary pockets at their base ..... 64. *G. oblanceolata* Bark.  
 Leaves lanceolate to linear-lanceolate, acute to acuminate; calyx sparsely glandular-hairy or sometimes glabrous ..... 71
71. Leaves mostly linear-lanceolate, less than 1 cm broad, acuminate; pedicel as long as the calyx or shorter ..... 54. *G. acutifolia* Fisch.  
 Leaves cordate to lanceolate; pedicel at least twice as long as the calyx ..... 60. *G. scorzonrifolia* Ser.
72. Leaves linear-lanceolate; mostly less than 1 cm wide ..... 54. *G. acutifolia* Fisch.  
 Leaves spatulate or lanceolate ..... 73
73. Leaves longer than the internodes; pedicel 5–8 mm long; calyx 2 mm long ..... 52. *G. krasheninnikovii* Šiškin  
 Leaves shorter than the internodes; pedicel at least 1 cm long; calyx 2.5–3 mm long ..... 110. *G. polyclada* Fenzl
74. Inflorescence more or less corymbose, rather dense; pedicel less than 7 mm long; leaves linear or subulate ..... 75  
 Inflorescence lax, paniculate ..... 94
75. Entirely glabrous ..... 76  
 Partly or wholly hairy ..... 88
76. Pedicel 3 mm long or less ..... 77  
 Pedicel at least in some flowers longer than 3 mm ..... 83
77. Basal leaves ensiform, 5–12 cm long, with 3 or more nerves ..... 12. *G. caricifolia* Boiss.  
 Basal leaves otherwise ..... 78
78. Leaves flat ..... 79  
 Leaves triquetrous, more or less subulate, less than 2 mm wide ..... 80
79. Calyx 2.5–3 mm long; petals 3.5–4 mm long; plants from the Caucasus or Romania ..... 23. *G. collina* Stev.  
 Calyx 2–2.5 mm long; petals 3–3.5 mm long; plants from Mongolia ..... 33. *G. mongolica* Bark.
80. Calyx 3.5–5 mm long; bracts narrow acuminate ..... 81  
 Calyx 2–3 mm long; bracts apiculate; stamens longer than petals ..... 82
81. Plants ca. 10 cm high, unbranched or, rarely, with 1 or 2 branches; leaves 1–3 cm long ..... 32. *G. capituliflora* Rupr.  
 Stem 30–45 cm high, with 2 or 3 branches in the upper part; leaves 4.5–6 cm long ..... 29. *G. preobrashenskyi* Czern.
82. Stem 30–40 cm high; pedicel 1–2 mm long; calyx lobes apiculate; ovules 16 ..... 21. *G. struthium* L.  
 Stem 30–80 cm high; pedicel 1 mm long or less; calyx lobes obtuse; ovules 12 ..... 22. *G. iberica* Bark.

83. Leaves narrow elliptic, 4–7 mm wide; calyx 4–5 mm long; plants from China ..... 25. *G. ellipticifolia* Bark.  
 Leaves linear less than 2 mm wide; calyx 2.5–4 mm long ..... 84
84. Stem 10–20 cm high ..... 85  
 Stem 20–70 cm high ..... 86
85. Leaves with broad base; calyx 4–5 mm long; petals one and a half times as long as the calyx ..... 35. *G. brachypetala* Trautv.  
 Leaves without broad base; calyx 3–4 mm long; petals two times as long as the calyx and with a shallow contraction between the limb and the claw ..... 31. *G. sambukii* Šiškin
86. Calyx 2–2.5 mm long; plants from N. Italy .... 20. *G. papillosa* Porta  
 Calyx 3–5 mm long ..... 87
87. Leaves 3–10 cm long; petals oblanceolate; plants from the Caucasus ..... 36. *G. steupii* Šiškin  
 Leaves 1–3 cm long; petals truncate to shallowly emarginate; plants from Mongolia and China ..... 30. *G. licentiana* Hand.-Mazz.
88. Calyx hairy ..... 89  
 Calyx glabrous ..... 90
89. Stem 5–20 cm high; calyx 3–4.5 mm long, glandular-pubescent; plants from the Ural ..... 34. *G. uralensis* Lessing.  
 Stem 25–40 cm high; calyx ca. 2 mm long; hairs eglandular; plants from Turkey ..... 77. *G. eriocalyx* Boiss.
90. Cauline leaves linear, obtuse, less than 2 mm wide ..... 91  
 Cauline leaves linear-lanceolate or linear-oblanceolate ..... 92
91. Stem unbranched, 6–10 cm high; pedicel shorter than the calyx; petals shallowly emarginate, pink ..... 42. *G. transylvanica* Spreng.  
 Stem branched; pedicel at least as long as the calyx; petals with rounded apex, white ..... 18. *G. fastigiata* L.
92. Leaves linear-lanceolate, 8–11 cm long; calyx lobes acuminate ..... 58. *G. scariosa* Tausch.  
 Leaves oblanceolate, less than 8 cm long; calyx lobes rounded ..... 93
93. Calyx 2–2.5 mm long; bracts and calyx lobes ciliated; seeds with acute tubercles ..... 15. *G. altissima* L.  
 Calyx 2.5–3.5 mm long, eciliate; seeds with flat tubercles ..... 17. *G. cephalotes* (Schrenk) Williams
94. Hairy in the upper part only; basal part of the stem glabrous ..... 95  
 Either completely glabrous or in the lower part hairy ..... 115
95. Pedicel and calyx glandular-hairy ..... 96  
 Calyx glabrous ..... 99
96. Leaves subulate triquetrous, less than 1 mm broad ..... 97  
 Leaves flat, 2–5 mm wide ..... 98
97. Bracts lanceolate, scarious; calyx lobes acuminate; petals with broad claw; ovules 3–8 ..... 67. *G. curvifolia* Fenzl  
 Bracts linear, obtuse, foliaceous; calyx with rounded lobes; petals oblong; ovules 16 ..... 9. *G. spergulifolia* Griseb.
98. Pedicel less than 5 mm long; leaves lanceolate 1–2 cm long, acute ..... 72. *G. aucheri* Boiss.  
 Pedicel 5–15 mm long; leaves spatulate or linear; subobtuse ..... 92. *G. diffusa* Fisch. & Mey.



99. Leaves lanceolate, oblanceolate or elliptic .....	100
Leaves linear .....	109
100. Leaves scabrous, grey-green or light green, with a prominent net of nerves .....	103
Leaves smooth, nerves not conspicuous .....	101
101. Leaves 2-3 cm long; petals one and a half times as long as the calyx; ovules 12 .....	92. <i>G. diffusa</i> Fisch. & Mey.
Leaves 2-6 cm long; petals twice as long as the calyx or longer .....	102
102. Basal leaves spatulate; petals with rounded apex; stem more or less viscous .....	109. <i>G. persica</i> Bark.
Basal leaves lanceolate; petals emarginate to shallowly bilobed; stem not viscous .....	102. <i>G. polyclada</i> Fenzl
103. Calyx 3-4 mm long; pedicel mostly longer than 1 cm .....	104
Calyx 2-2.5 mm long; pedicel mostly shorter than 1 cm .....	106
104. Calyx teeth acuminate, ciliate; petals cuneate; ovules 4 only .....	73. <i>G. pallidifolia</i> Bark.
Calyx teeth rounded; petals with broad claw; ovules 8 .....	105
105. Leaves lanceolate, sessile; stem 50-60 cm high; calyx lobes mostly eciliate .....	71. <i>G. pallida</i> Stapf
Leaves more or less spatulate, narrowed at base; stem 10-40 cm high .....	68. <i>G. libanotica</i> Boiss.
106. Leaves 3-5 cm long; petals cuneate .....	72. <i>G. aucheri</i> Boiss.
Leaves less than 3 cm long; petals with broad claw .....	107
107. Calyx lobes acute, ciliate; petals truncate to shallowly emarginate, ca. 1 mm broad .....	74. <i>G. virgata</i> Boiss.
Calyx teeth eciliate; petals with rounded apex, ca. 0.5 mm wide .....	108
108. Leaves 1-1.5 cm long, obtuse; calyx lobes emarginate; seeds with acute tubercles .....	70. <i>G. damascena</i> Boiss.
Leaves 1-2.5 cm long, acute; calyx teeth acute; seeds with obtuse tubercles .....	71. <i>G. pallida</i> Stapf
109. Calyx 2-3 mm long .....	110
Calyx 3-3.5 mm long .....	113
110. Leaves linear-lanceolate, narrowly acute .....	111
Leaves not so .....	112
111. Calyx lobes rounded; plants from Hungary ..	19. <i>G. × digenea</i> Borbás
Calyx lobes acuminate; plants from Turkey .....	72. <i>G. aucheri</i> Boiss.
112. Leaves 1-1.5 mm wide, fleshy; pedicel 1-1.5 cm long; stamens shorter than the petals .....	75. <i>G. transcaucasica</i> Bark.
Leaves 3-5 mm wide; pedicel ca. 5 mm long; stamens longer than the petals .....	53. <i>G. belorossica</i> Bark.
113. Leaves 1-2 mm wide, mostly triquetrous .....	56. <i>G. meyeri</i> Rupr.
Leaves 2-6 mm wide, flat .....	114
114. Calyx and pedicel glabrous or glandular-hairy; leaves 1-6 cm long .....	55. <i>G. stevenii</i> Fisch.
115. Stem completely glabrous .....	116
Stem hairy in the lower part or all over .....	138
116. Leaves ensiform, with three or more nerves ..	14. <i>G. graminifolia</i> Bark.
Leaves not so .....	117
117. Leaves linear, less than 3 mm wide .....	118

- Leaves not linear, more than 3 mm wide ..... 128
118. Leaves less than 1 mm wide, not more than 1 cm long, triquetrous or semi-orbicular in section; plants 5–15 cm high ..... 119
- Leaves more than 1 cm long, mostly flat ..... 121
119. Styles very short; calyx teeth semi-circular, ciliate; petals with rounded apex ..... 113. *G. macedonica* Vandás
- Styles long; calyx lobes acute, eciliate; petals truncate to shallowly bilobed ..... 120
120. Pedicel 1–1.5 cm long; petals truncate; leaves and bracts papillose .... 10. *G. davisii* Bark.
- Pedicel less than 6 mm long; leaves and bracts not papillose; petals shallowly bilobed ..... 6. *G. rosea* Bark.
121. Pedicel and calyx glandular-hairy; plants from Greece ..... 8. *G. achaia* Bornm.
- Pedicel and calyx glabrous ..... 122
122. Calyx 2–2.5 mm long; bracts foliaceous, obtuse ..... 123
- Calyx 2.5–4 mm long; bracts scarious, acute ..... 124
123. Calyx lobes rounded; petals twice as long as the calyx; ovules mostly 4 ..... 105. *G. arabica* Bark.
- Calyx lobes apiculate; petals one and a half times as long as the calyx; ovules mostly 12 ..... 95. *G. szovitsii* Fisch. & Mey.
124. Calyx tubiform; petals linear, ca. 10 mm long; root tuberous ..... 125. *G. intricata* Franch.
- Calyx campanulate; petals cuneate; root normal ..... 125
125. Stem with 5–8 fls. only; leaves scabrous, 1–3 cm long, falcate; ovules 8 ..... 66. *G. briquetiana* Šiškin
- Stem with more than 10 fls.; leaves not scabrous, mostly longer than 3 cm; ovules 12–16 ..... 126
126. Leaves linear, basal ones with a broad scarious base; calyx 3.5–4.5 mm long ..... 37. *G. tenuifolia* M. Bieb.
- Leaves never with a scarious base; calyx 2.5–3 mm long ..... 127
127. Calyx lobes obtuse, mostly ciliate; plants from S. Ural or Asia ..... 27. *G. patrinii* Ser.
- Calyx lobes acute, eciliate; plants from C., W. and S. Europe ..... 11. *G. repens* L.
128. Calyx lobes obtuse to rounded; bracts small, foliaceous ..... 129
- Calyx lobes acute or apiculate; bracts scarious ..... 133
129. Leaves lanceolate to linear-lanceolate, sessile, narrowly acuminate .... 130
- Leaves more or less spatulate, narrowed at base, acute ..... 131
130. Petals cuneate; calyx lobes semi-orbicular; ovules 8 ..... 48. *G. paniculata* L.
- Petals with broad claw; calyx lobes oblong; ovules 12; plants from Italy or Turkey ..... 50. *G. arrostii* Guss.
131. Petals hardly longer than the calyx, white; stem 50–70 cm high ..... 91. *G. pseudomelampoda* Gauba & Rechinger f.
- Petals twice as long as the calyx, white with purple veins; stem less than 50 cm high ..... 132
132. Root thick and woody; stem diffusely branched; leaves with papillose margin ..... 104. *G. capillaris* (Forsk.) Christ.
- Biennal or mostly annual; leaves not papillose .... 106. *G. antari* Post
133. Leaves 3–6 cm long, narrowly elliptic; calyx lobes and bracts ciliate;

- plants from Mongolia ..... 26. *G. davurica* Turcz.  
 Leaves mostly less than 2 cm long, not narrowly elliptic ..... 134
134. Calyx twice as long as wide; petals cuneate ..... 135  
 Calyx as long as wide; petals oblong, truncate to emarginate ..... 136
135. Leaves oblanceolate; calyx lobes and bracts ciliate; ovules 4 only .....  
 ..... 76. *G. aulieatensis* Fedtsch.  
 Leaves triangular, acuminate; calyx teeth and bracts ciliate; ovules 8  
 ..... 125. *G. intricata* Franch.
136. Plants 30–60 cm high ..... 137  
 Plants 10–30 cm high; leaves oblong to oblanceolate, less than 5 mm  
 wide; petals white with purple veins; anthers purple .....  
 ..... 100. *G. silenoides* Rupr.
137. Leaves elliptic, scabrous, with prominent veins; stem rigid; petals with  
 broad claw, pink ..... 74. *G. virgata* Boiss.  
 Leaves narrowly lanceolate, smooth; petals oblong, white with purple  
 veins ..... 99. *G. elegans* M. Bieb.
138. Leaves less than 3 mm wide ..... 139  
 Leaves more than 3 mm wide, linear-lanceolate; calyx 2–2.5 mm with  
 semi-orbicular lobes ..... 48. *G. paniculata* L.
139. Calyx and pedicel at least with some hairs; bracts foliaceous ..... 140  
 Calyx and pedicel glabrous; bracts scarious ..... 142
140. Calyx 3–4 mm long; stem 4–10 cm high, with 3–5 fls.; seeds with acute  
 tubercles ..... 7. *G. nana* Bory & Chaub.  
 Calyx 2–3 mm long; inflorescence a rich panicle consisting of dichasia;  
 leaves fleshy; stem 10–30 cm high ..... 141
141. Leaves obtuse; the whole plant glandular-hairy; petals truncate to  
 emarginate ..... 93. *G. adenophora* Boiss. & Buhse  
 Leaves mucronate; stem slightly hairy in the upper part or entirely  
 glabrous; petals emarginate to truncate 94. *G. mucronifolia* Rechinger f.
142. Stem 10–20 cm high, with 3–10 fls., unbranched; flowers pink .....  
 ..... 65. *G. nabelekii* Šiškin  
 Stem more than 30 cm high; inflorescence paniculate; fls. white .....  
 ..... 63. *G. × castellana* Pau

## 5. SPECIES DESCRIPTIONS

### I. Subgenus *Gypsophila* p. 36

#### 1. Section *Exscapae* Williams p. 37

##### Subsection A. *Pulvinares* Boissier p. 37

1. *G. aretioides* Boissier, Diagn. ser. 1. (I): 9 (1842); Boiss., Fl. Or. 1: 538 (1867); Šiškin in Komarov, Fl. U.S.S.R. 6: 744 (1936); Parsa, Fl. de l'Iran: 1019 (1951).

Heterotypic synonym: *G. raddeana* Regel, Act. Hort. Petrop. 10: 698 (1887–89); Gartenfl. 41: 89, fig. 3–8 (1892). Type: Radde s.n. from Kopet-Dagh in Turkmenia (TB not seen).

Plate I, Fig. 1–7. p. 58

Root thick, woody; plant densely cushion-shaped 10–200 cm in diam., stemless, glabrous; leaves small, linear, triquetrous, 1–3 mm long, about 1 mm wide; flowers mostly solitary, rarely two or three

together on one peduncle; calyx campanulate-turbinate, 2–2.5 mm long, 1.5 mm wide, with ovate lobes, calciumoxalate crystals very dense in the parenchyma of the green part, less dense in the hyaline part; petals oblanceolate, with rounded apex, pink or white, about one and a half times as long as the calyx; stamens exceeding the petals, spreading; ovary obovoid, with ca. 16 ovules; styles erect, slightly incurved, stigma terminal; capsule slightly longer than the calyx, 4-valved, with 2–4 seeds; seeds 1 mm long, 1 mm broad, 0.5 mm thick, echinate, with acute tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

Mountain plant, growing on bare calcareous or dolomitic rocks and on rocky slopes, at an elevation of 200–2700 m.

Geographic distribution: Turkmenia, N. Iran, and the Caucasus.

Type: Iran: Mt. Damawand, Aucher-Eloy 538, holotype (G. Boiss.); isotypes (BM, G, K, P).

IRAN: Mt. Damawand, Kotschy 607 (BM, P); *ibid.*, A. C. Frodt s.n. 1933 (K); Prov. Khorasan: Mt. Hazar Masjid between Ardak and Tolgor, Rechinger 7490 (K, W); Mt. Nishapur, above Akhloamat, Rechinger 5250 (K, W); Shahkuh Mazenderan, Koelz 16344 (W); Mt. Kopet-Dagh, near Alamli, Rechinger 4840 (K, W); Prov. Damghan-semnan, between Firuzkuh and Bashm, Rechinger 1181 (K, W); Gorgan, Ketul, Shanf 429 (W); Prov. Khorasan: Mt. Kopet-Dagh, near Alamli, Rechinger 1663 (K, W); W. Elburz, Mt. Asadbar, Bornmüller 6337 (BM, E, K, M); Kùh-i-Wafs, near Hamadan, Strauss s.n. 1910 (JE); N. Damawand, Buhse s.n. 1859 (P); Lar valley, N.E. of Tehran, Barres Sons Rd. s.n. 1909 (K). TURKMENIA: Near Ashkhabad, Litwinow 124 (E, JE, M, P); Tangan, N. V. Androsov and L. M. Bubyryj 2557 (LE); Mt. Kopet-Dagh, Michelson 66 (E, M); *ibid.*, M. Chapan, Korovin 124 (E, G, K). TRANSCAUCASIA: Nakhichevan, Prov. St. Viae, Neqram, Pilipko s.n. 1933 (M).

The cushions of *G. aretioides* are very firmly attached to the substrate. From a distance they have the appearance of lichens covering the rock-surface. The cushion itself is composed of very many thin interwoven branches becoming thinner at the top and ending in very small stems which are covered with small imbricate leaves. According to V. Savič (Comments on the biology of *G. aretioides*, in Mon. du Jard. Bot. de Tiflis 27: 19–25 (1913)) these cushions can absorb humidity from the air without the use of roots. This species is capable of propagating easily by means of cuttings which form roots directly. Occasionally cushions without any roots may produce new leaves and flowers when they are put in a suitable damp place (Šiškin in Komar., Fl. U.S.S.R. 6: 745 (1936)).

Economical use: In Turkmenia, where woody plants are rare, the cushions of *G. aretioides* are used for fuel.

2. *G. imbricata* Ruprecht, Fl. Cauc. 1: 176 (1869); Williams, Journ. of Bot. 27: 321 (1889); Šiškin in Komarov, Fl. U.S.S.R. 6: 745 tab. 46 fig. 7 (1936).

Homotypic synonyms: *G. aretioides* var. *caucasica* Boiss., Fl. Or. Suppl. 84 (1888); *G. aretioides* ssp. *imbricata* (Rupr.) Bornm., Beih. Bot. Centralb. 32: 362 (1914); *G. aretioides* var. *imbricata* (Rupr.) Somm. et Lev., Act. Hort. Petr. 16: 66 (1900).

Plate I, Fig. 8–15. p. 58

This species is very similar in general morphology and habit to the preceding. For this reason some authors consider it a ssp. or variety of the latter. Yet, it differs clearly from it in the following points: The leaves are larger, 2–2.5 mm long; the inflorescence bears 2–3

flowers, whereas in *G. aretioides* the flowers are mostly solitary; the calyx is 2.5–3 mm long, with apiculate lobes and more or less sinuate margin; the petals are twice as long as the calyx, triangular, emarginate, or with sinuate apex; the seeds are larger, over 1 mm in diam., with narrow acute tubercles, more compressed on both sides. Fl. Jul.–Aug., fr. Aug.–Sept.

Type: Caucasus: North Ossetia, riv. Ardon, near Alagera, Ruprecht (LE not seen). Topotypes: Ossetia: between Alagera and Misvitzy, along the riv. Ardon, A. H. and V. F. Brotherus s.n. (FI); near Mizartzy, Brotherus, V.F. 31 (W); along the riv. Ardon, A. H. and V. F. Brotherus 130 (BM, P).

Geographic distribution: This species is a narrow endemic of the Central Caucasus. It inhabits the northern hills of the main chain of mountains along the river Ardon; on calcareous rocks, at an elevation approximately 800 m. Considering the morphological similarity of the two species, *G. aretioides* Boiss. and *G. imbricata* Rupr., and their geographic distribution, it seems not impossible that originally they occupied one area and have a common origin. *G. imbricata* Rupr. has a more restricted disposition with more specialised characters and habitat.

#### Subsection B. *Crassae* Barkoudah subsect. nov. p. 38

3. *G. serpylloides* Boissier et Heldreich in Boiss., Diagn. ser. 1 (VIII): 59 (1849); Boiss., Fl. Or. 1: 539 (1867).

Plate I, Fig. 16–23. p. 58

Caespitose glabrous low plants with prostrate thin stems, producing at the nodes fibrous roots; flowering shoots 2–5 cm long; leaves linear-subulate, fleshy, with sterile short shoots in their axil, longer than the internodes, 1–6 mm long and about 1 mm wide; flowers 1–5 in a dichasium; bracts leafy, ciliate at base; pedicel mostly shorter than the calyx; calyx campanulate-tubiform, 3–4 mm long, with ovate, acuminate, ciliate lobes; petals linear, truncate or sinuate, longer than the calyx, pink; stamens shorter than the petals; ovary ovoid with spreading styles; ovules 16; capsule as long as the calyx, with approximately 8 seeds; seeds 0.5 mm long, 0.5 mm broad, with small flat tubercles. Fl. Jul., fr. Aug.

In high dry mountain pastures at 2000–2600 m.

Type: Turkey: Prov. Konya, Mt. Gheidagh, near Isaura, Heldreich s.n. 1845. Holotype (G-Boiss.), isotypes (E, G, L, LE, M, P).

This species is at present only known by the type collection.

4. *G. saponarioides* Bornmüller et Gauba, Fedde Repert. 39: 89, tab. CXCVII B, fig. 2 (1935); Parsa, Fl. de l'Iran I: 1020 (1951).

Plate I, Fig. 24–33. p. 58

Root woody, about 1 cm thick; stems many, erect, thin, glabrous below, glandular-pubescent in the upper part, up to 5 cm high; leaves linear, fleshy, obtuse, narrowed at base, up to 6 mm long and 1 mm broad, glabrous; flowers in a simple dichasium at the top of the stem, sometimes also solitary in the lower leaf-axils; pedicel 5–7 mm long, glandular-pubescent; bracts ovate-acuminate, membranous,

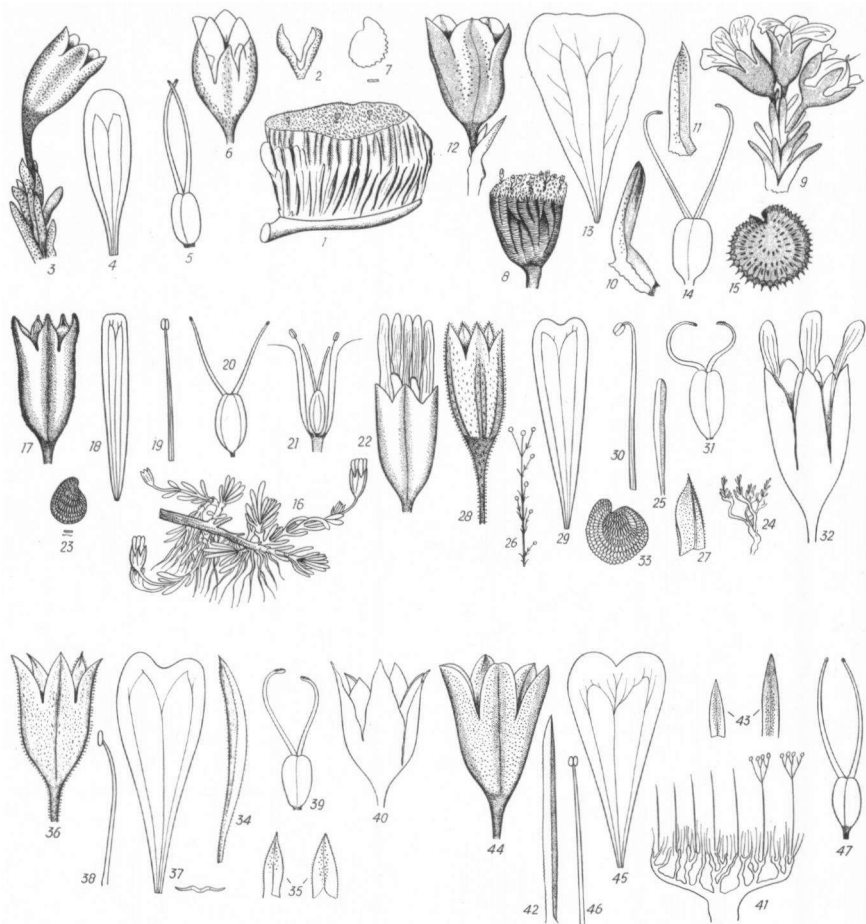


Plate I. Fig. 1-7: *G. arctioides*; 1: a piece of a whole plant; 2: bracts; 3: calyx; 4: petal; 5: ovary; 6: capsule; 7: seed. Fig. 8-15: *G. imbricata*; 8: a piece of a whole plant; 9: a flowering stem; 10: leaf; 11: bract; 12: calyx; 13: petal; 14: ovary; 15: seed. Fig. 16-23: *G. serpylloides*; 16: a part of a whole plant; 17: calyx; 18: petal; 19: stamen; 20: ovary; 21: a longitudinal section of a flower; 22: capsule; 23: seed. Fig. 24-33: *G. saponarioides*; 24: caudex; 25: leaf; 26: a flowering stem; 27: bract; 28: calyx; 29: petal; 30: stamen; 31: ovary; 32: capsule; 33: seed. Fig. 34-40: *G. adenophylla*; 34: leaf; 35: bracts; 36: calyx; 37: petal; 38: stamen; 39: ovary; 40: capsule. Fig. 41-47: *G. rosea*; 41: a whole plant; 42: leaf; 43: bracts; 44: calyx; 45: petal; 46: stamen; 47: ovary

glandular-hairy on their lower side; calyx long-campanulate, 4–5 mm long, 2 mm wide, glandular-hairy, with ovate acuminate teeth; no calcium oxalate crystals in the parenchyma; petals oblanceolate, emarginate, one and a half to two times as long as the calyx, purplish-pink; stamens shorter than the petals; ovary obovoid, with short incurved styles; stigma oblong, terminal; ovules 20; capsule as long as the calyx, four-valved; seeds many, over 1 mm long, over 1 mm broad, with flat tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

In crevices of calcareous rocks, at about 3000 m alt.

Type: Iran: prov. Kazwin, Mt. Alburz, Keredj valley, Gauba & Sabeti s.n. Holotype (B), isotype (W).

At present this species is not known from any other collection.

##### 5. *G. adenophylla* Barkoudah sp. nov.

Plate I, Fig. 34–40. p. 58

Perennis, plus minusve pulvinaris; radice ca. 5 mm crassa; caulibus glanduloso-pubescentibus, numerosis, 5–7 floriferis, ceteris sterilibus; caulibus floriferis ca. 4 cm altis, erectis, fragilibus, haud ramosis; foliis 2–4 in quoque caule florifero, linearibus, crassiusculis, subteretibus, mucronatis, basi angustatis, glanduloso-pubescentibus, 5–10 mm longis et 1 mm latis; inflorescentia dichasialis, semel ad ter composita; pedicellis calyce aequilongis vel brevioribus, glanduloso-pubescentibus, 2–5 mm longis; bracteis ovatis, acuminatis, scariosis, facie dorsali glanduloso-pubescentibus; calycibus campanulatis, glanduloso-pubescentibus, 4–4.5 mm longis et 3 mm latis, fere ad medium partitis, laciniis ovatis, acuminatis; petalis late cuneatis, bilobis vel emarginatis, ad basim angustatis, calyce duplo longioribus et 2.5 mm latis; staminibus exsertis, petalis brevioribus, basi in glandem incrassatis; ovario obovoideo, stylis divergentibus, ovulis 16; capsula quadri-valvis. Fl. Jul.–Aug., fr. Aug.–Sept.

In crevices of vertical limestone rocks and on rocky soil, on high mountains at 3000–4000 m alt.

Type: Turkey: Wilayet Van, distr. Gavas, Artos Dagi, Davis 22 751 (O. Polunin). Holotype (E), isotype (K).

TURKEY: Wilayet Hakkari, Kara Dag, Davis 24 493 (O. Polunin) (E, K); Wilayet Bitlis, Pelli Dag, above Pelli, Davis 22 497 (O. Polunin) (E, K).

This new species differs from the closely related *Gypsophila saponarioides* Bornm. et Gauba by being glandular-hairy throughout; the leaves are pointed; the inflorescence is purely dichasial, without any axillary flowers, the pedicel is shorter than the calyx, never longer; the calyx is campanulate and incised to about the middle; the petals are broader; ovules only 16.

These two species are not only similar to each other in their morphology, but also in their habitat. Their areas are closest among the species of the subsection *Crassa* Bark. However, it seems that they do not overlap, both having very restricted areas.

##### 6. *G. rosea* Barkoudah sp. nov.

Plate I, Fig. 41–47. p. 58

Perennis, dense caespitosa pulvinaris; radice 5–10 mm crassa; caulibus numerosis, erectis, glaberrimis, haud ramosis, fragilibus, floriferis 4–7 cm altis; foliis ad basim caulis approximatis,

linearibus, triquetris, carnosis, 0.5–2 cm longis et 0.5 mm latis, glaucescentibus, apice acutis, basi dilatatis scariosis, margine papillois, caulibus uni- vel biparibus; inflorescentia trichotomodichasialis; bracteis foliosis, margine scariosis; pedicellis calyce aequilongibus, ca. 6 mm longis; calycibus turbinato-campanulatis, viridi-purpureis, ad medium partitis, laciniis ovatis obtusis, margine scariosis; petalis triangularibus, roseis, apice bilobis vel emarginatis, basi angustatis, calyce duplo longioribus; staminibus exsertis, petalis brevioribus; ovario obovoideo, stylis erectis petalis brevioribus, ovulis ca. 16; capsula ignota. Fl. Jul.

In rock crevices, at about 2400 m alt.

Type: Turkey: Wilayet Tunceli: Munzur Dag above Ovacik, Davis 31336. Holotype (E), isotype (K).

This species can be easily distinguished from other members of the section *Excapae* Williams by being glabrous and having longer triquetrous leaves; other differences may be observed by comparing the illustrations. It may also be compared with *Gypsophila davisii* Bark. of the section *Gypsophila*. But the leaves of *G. rosea* are triquetrous, and longer, with papillose edge; the pedicel is as long as the calyx, the bracts are hairless on the edge; the calyx is larger; the petals are broader, with bilobed apex, and the ovules are 16. *G. rosea* bears also some resemblance to *Gypsophila spergulifolia* Griseb., *G. acantholimoides* Bornm., and *G. graminifolia* Bark., but is not likely to be confused with them.

## 2. Section *Gypsophila* p. 38

7. *G. nana* Bory et Chaub., *Nouv. Fl. Pelop.* p. 26 (1838); Boiss., *Fl. Or.* 1: 538 (1867); Halácsy, *Fl. Graeca* 1: 192 (1900); Hayek, *Prod. Fl. Pen. Balcan.* 1: 219 (1927).

Plate II, Fig. 1–9. p. 63

Stem glandular-pubescent, thin, 4–10 cm high; leaves linear-oblancoolate, glaucous, few on the flowering stem, 3–12 mm long, and 1–2.5 mm broad; inflorescence dichasial, 3–8 flowered, bracts leafy; pedicel longer than the calyx, glandular-hairy; calyx campanulate, glandular-pubescent, 3.5–4 mm long, and 3 mm wide, with ovate rounded or apiculate lobes; petals twice as long as the calyx, pink or white, emarginate, with a shallow contraction between the limb and the claw; stamens shorter than petals; ovary ovoid, with 20 ovules; capsule as long as the calyx, seeds 1 mm long and 1 mm broad, 0.5 mm thick, with acute tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

Mountain plant, 1500–2000 m alt., on rocks and on stony slopes in the alpine zone of the mountains of Greece.

a. var. *nana*: Leaves glandular-puberulent to glandular-pubescent.

Type: Bory et Chaub. from Greece (STR not seen).

Geographic distribution: Greece: Peloponnesus, Crete.

GREECE: Peloponnesus: Mt. Taiyetos, Heldreich 930 (L); *ibid.*, E. Psaride 305 (L), and 909 (W); Mt. Páron, Heldreich s.n. 1844 (L), and n. 305 (FI); Mt. Taiyetos, Heldreich 3804 (JE, W); *ibid.*, near Magóula, Maire and Petitmengin 1000 (W); *ibid.*, Pichler s.n. 1876 (L, P, W); *ibid.*, Orphanides s.n. 1871 (P). CRETE: Near Lmoichi, Mt. Valakia, Baldacci 55 (BR, W); Khora Sphakion above Helline Seli, Heldreich s.n. 1846 (P); *ibid.*, V. Raulin 593 (P); Mt. Parnassos near Dokanistra, Leonis 181 (W); *ibid.*, Baldacci 109 (W).



b. var. *glabrifolia* Halácsy, Suppl. Consp. Fl. Graec. p. 18 (1904).

Leaves completely glabrous; upper part of the stem, bracts, pedicels and calyces glandular hairy as the type variety with which it agrees also in other characters.

Type: Central Greece: Mt. Gíona, Maire and Petitmengin 1428. Holotype (W).

Geographic distribution: Very rare in Central Greece.

CENTRAL GREECE: Gerania, Mégara, Tuntas 801 (W).

8. *G. achaia* Bornmüller, Fedde Repert, 25: 33 (1928).

Plate II, Fig. 10–16. p. 63

Stems 5–10 cm high, glabrous; leaves linear, obtuse, 1–2.5 cm long and 1–3 mm broad; inflorescence with 3–10 flowers, glabrous; bracts lanceolate, acuminate, glabrous; pedicel 5–15 mm long, bearing some glandular hairs; calyx 3–4 mm long, glandular-hairy, with ovate lobes; petals twice or more as long as the calyx, emarginate to sinuate; ovary ovoid with long divergent styles; ovules 12. Capsule unknown.

On rocks, in mountainous regions at about 1000 m alt.

Type: Greece: Peloponnesus: Achaia, near Kalávrita, Mt. Kastro, Bornmüller 187 Iter. Gr. 1926. Holotype (B. destroyed). Isotypes (G-Boiss., K, W).

This species differs from the closely related species *G. nana* Bory et Ch. by its glabrous leaves and stem, its glabrous lanceolate acuminate bracts, sinuate calyx lobes, white petals and only 12 ovules. *Gypsophila nana* var. *glabrifolia* Halácsy is more similar to this species by having glabrous leaves. It is not impossible that *G. nana* var. *glabrifolia* Halácsy is a hybrid between *G. nana* and *G. achaia*, but this could only be assured by genetical study.

9. *G. spergulifolia* Grisebach, Spicil. Fl. Rumel. 1: 183 (1843), non Boiss. Fl. Or. 1: 559 (1867), Hayek, Prod. Fl. Pen. Balc. 1: 221 (1927).

Homotypic synonym: *G. sp.* forma *albanica* Vis. et Panč., Mem. Inst. Ven. 15: 15 (1870).

Stem 5–25 cm high, glabrous below, glandular-hairy above, branched; leaves linear, triquetrous, acute, 4–16 mm long, 0.5–1 mm wide; inflorescence dichasial, pedicel longer than the calyx, to 15 mm long, glandular-hairy; calyx campanulate-turbinate, 2.5–3 mm long, glandular-hairy, with ovate lobes, petals oblong-cuneate, twice as long as the calyx, pink; ovules 16; capsule as long as the calyx; seeds 1 mm long, 1 mm broad, with small flat tubercles.

On soils derived from serpentine rocks, at 500–1500 m alt.

a. var. *spergulifolia*: Stems few, with scattered glandular hairs above; leaves not densely imbricate at the base of the stem, always 2 on one node.

Type: West Albania: Mt. Puka near Alessia, Grisebach s.n. Holotype (GOET), isotype (K).

Geographic distribution: Very rare in Albania.

ALBANIA: near Renci riti, Scutari, Baldacci 203 (BR, K, P, W).

b. var. *serbica* Vis. et Panč., Mem. Inst. Ven. 15: 15 tab. 20, fig. 3 (1870); Hooker's Ic. Pl.: Sp. minus cognitae tab. 3352; Hayek, Prod. Fl. Pen. Balcan. 1: 221 (1927).

Homotypic synonym: *G. serbica* (Vis. et Panč.) Degen, Mag. Bot. Lap. 4: 122 (1905) (errore: *G. serbica* (Grb.) Degen).

Plate II, Fig. 17–24. p. 63

Plants caespitose, densely glandular-pubescent; leaves densely imbricate at the base of the stem, occasionally 3 or 4 on one node. This variety is much more common than the type variety and is often confused with it which is, so far known, restricted to Albania.

Type: Serbia: Mt. Zlatobor, Visiani s.n. (not seen).

Geographic distribution: Albania, Serbia and Bosnia.

ALBANIA: Moskopolë (Voskopojë), Alston and Sandwith 2552 (BM, K); Djakova, (under Cafa Morins) near Trapoja, Jávorka s.n. 1918 (K). SERBIA: Divcibare, Pavloviz (K); Mt. Zlatibor, Uýizeer range, Perovic s.n. 1877 (W); *ibid.*, Wanon s.n. 1875 (W); *ibid.*, near Ribuica, Kosarnis (FI); Mt. Divis Bare,<sup>?</sup> (FI). BOSNIA: Between Zlatua and Mt. Smolin, near Zepce, Maly s.n. 1934 (K).

10. *G. davisii* Barkoudah sp. nov.

Plate II, Fig. 25–32. p. 63

Perennis, dense caespitosa, pulvinaris; caulibus numerosis filiformibus glaberrimis, erectis, haud ramosis, 5–10 cm altis, internodiis brevissimis ca. 1 cm longis; foliis perparvis linearibus, rigidis, laete virescentibus, facie dorsali nervis salientibus, nervo mediano cariniformi, apice acutis, basi dilatatis minute ciliatisque, ca. 1 cm longis et 1 mm latis, ad basim caulis approximatis, caulibus minoribus; bracteis triangularibus margine scariosis minute ciliatisque; inflorescentia dichasialis, semel ad ter composita, floribus 3–7 in queque cauli; pedicellis calyce longioribus, capillaribus, ca. 1 cm longis; calycibus turbinato-campanulatis, 3 mm longis et 1 mm latis, ad ultim tertium partitis, dentibus ovatis, subacutis, ciliatis; petalis linearicuneatis, retusis, basi angustatis, roseis, calycem medio superantibus 4–5 mm longis et  $\frac{3}{4}$  mm latis; staminibus petalis aequilongis; ovario obovoideo, stylis erectis, petalis brevioribus; ovulis 8–12; capsula calyce longiore, quadrivalvis, 5 mm longa; seminibus ca. 1 mm longis, gibbosis, radícula saliente. Fl. Jul.–Sept.

Type: Turkey: Wilayet Mügla, Sandras Dag near Gokca, 1700 m alt., Davis 13516 A. Holotype (E), isotype (K).

TURKEY: Wilayet Mügla, Sandras Dag, near Kara Kaya, Schwarz 47 (JE).

Note: Mr. Schwarz in 1938 discovered this new species in his own collection, but his work on this collection was interrupted by the war and the new species could not be described. After coming across this species in Davis' material I received Mr. Schwarz' collection on loan and I found that the two cited plants belong to the same new species. After corresponding with Mr. Schwarz I was kindly granted permission to publish this species with my name. It differs from the similar species *Gypsophila rosea* Bark. by having smaller flowers, the calyx being devoid of calcium oxalate crystals in its parenchyma, the petals being narrower and smaller and the leaves being smaller and flat. From *Gypsophila spergulifolia* it differs by having shorter, flat leaves, lower stems, and being quite glabrous. It also shows some similarity to *Gypsophila acantholimoides* Bornm. and *Gypsophila graminifolia* Bark., but can easily be distinguished by the characters listed in the key. In habit it resembles the genus *Tunica*.

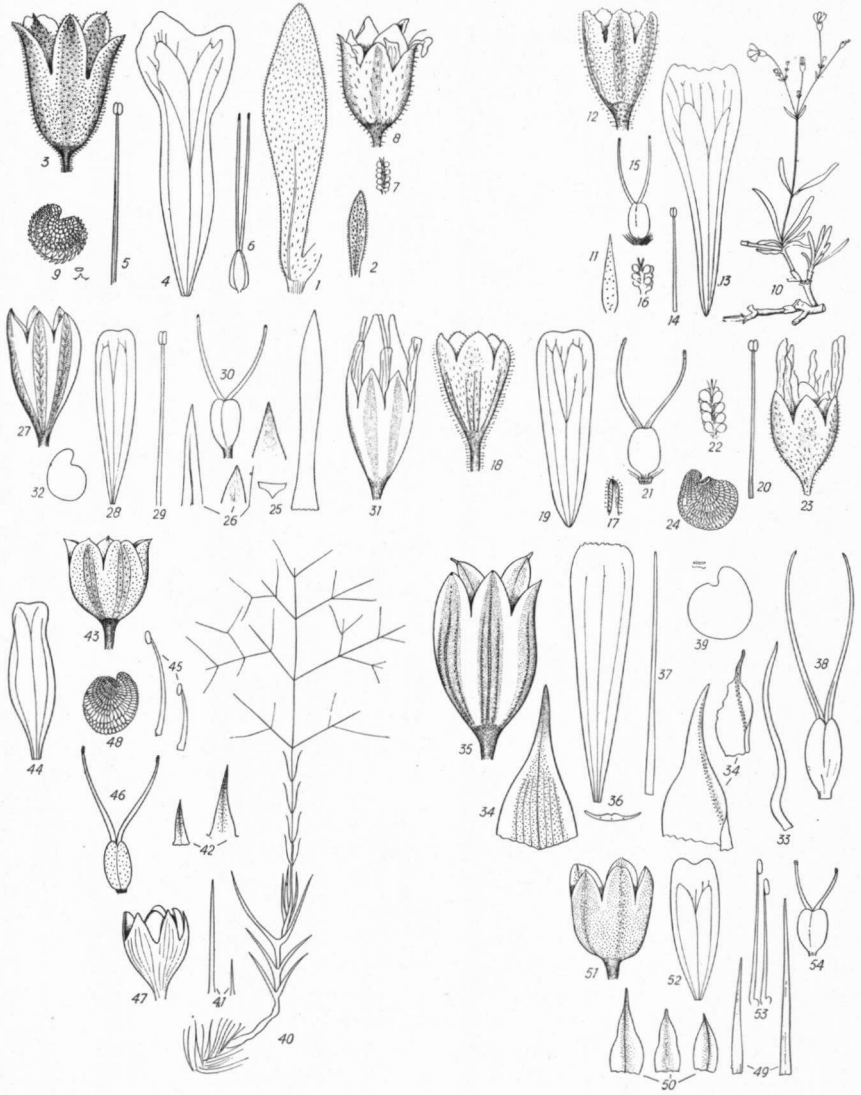


Plate II. Fig. 1-9: *G. nana*; 1: leaf; 2: bract; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: placenta; 8: capsule; 9: seed and tubercles. Fig. 10-16: *G. achaia*; 10: stem; 11: bract; 12: calyx; 13: petal; 14: stamen; 15: ovary; 16: placenta. Fig. 17-24: *G. spergulifolia*; 17: bract; 18: calyx; 19: petal; 20: stamen; 21: ovary; 22: placenta; 23: capsule; 24: seed. Fig. 25-32: *G. davisii*; 25: leaf with its cross-section; 26: bract; 27: calyx; 28: petal; 29: stamen; 30: ovary; 31: capsule; 32: seed. Fig. 33-39: *G. caricifolia*; 33: leaf; 34: bracts; 35: calyx; 36: petal with its cross-section; 37: stamen; 38: ovary; 39: seed. Fig. 40-48: *G. acantholimoides*; 40: stem; 41: leaves; 42: bracts; 43: calyx; 44: petal; 45: stamens; 46: ovary; 47: capsule; 48: seed. Fig. 49-54: *G. graminifolia*; 49: leaves; 50: bracts; 51: calyx; 52: petal; 53: stamens; 54: ovary

11. *G. repens* L.

*Saponaria caule simplici, foliis subulatis planis, ex alis ramulosa* L., Hort. Cliff. 166 (1753). *G. repens* L., Sp. Pl. 407 (1753); Lamarck, Encyclop. method. Bot. Illustr. 2: pl. 375. f. 2 (1786); Jacq., Fl. Austr. 5: 407 (1778); Reichb., Ic. Fl. Germ. tab. 211 (1844); Brügger, zur Fl. Tirols. Zeitschr. Ferd. Must. 3. Folg. 4. Heft: 78 (1860); Rouy et Fouc., Fl. France 3: 156 (1896); Zapalowicz, Consp. Fl. Gall. 3: 100 (1906); Ascherson u. Graebner, Syn. Mitteleur. Fl. 5 (2): 236 (1929); Hegi, Fl. Mitt. 3: 311 (1939).

Homotypic synonym: *Saponaria diffusa* Lam., Fl. Fr. 2: 540 (1792).

Heterotypic synonyms: *Gypsophila dubia* Willd., Enum. Hort. Suppl. 23 (1813). Type: Cult. in Hort. Bot. Berl. (B-Willd.)!; *G. repens* L. var. *pygmaea* Beauverd, Bull. Murith. 37: 154 (1912). Type: Beauverd s.n. 1911, from Switzerland, Valais (G)! *G. repens* L. var. *dioica* Beauverd, Bull. Soc. Bot. Geneve 2<sup>o</sup> ser. 1: 304 (1909). Type: Beauverd 573 from France, Haute Savoie, Dorau (G)! an aberrant ♀ form.

Caespitose, glabrous, glaucous; stems 5–25 (55) cm high, branched in the upper part, ascending at the base or erect; leaves linear, acute to obtuse, 1–3.5 cm long, 1–2.5 mm broad, often falcate, basal ones aggregate, cauline ones few; inflorescence a small panicle of dichasia; bracts deltoid, acuminate, scarious; pedicel one to five times as long as the calyx; calyx campanulate, 3–4 mm long, with ovate acute lobes; petals cuneate, twice as long as the calyx, shallowly emarginate to bilobed, white to pink, rarely red; stamens longer than the calyx, divergent; ovary ovoid; styles long, divergent; ovules 16–20; capsule slightly longer than the calyx, deeply 4-valved; seeds over 1 mm × over 1 mm, with acute tubercles, black.

This is an alpine species growing on rocks and slopes to an elevation of about 2000 m. By means of the water of rivers and streams, its seeds are swept down, even as far as sea-level. This is the case with several of the rivers springing from the mountains where it has its natural habitat. On the banks of the lower parts of these rivers it may grow on clay and under conditions that diverge widely from its original habitat. This apparently accounts for its great variability.

a. var. *repens*: Stems 5–10 cm high, erect; leaves up to 1.5 cm long, 1–2 mm broad, obtuse; petals emarginate.

Type: Hort. Cliff. 166 (BM) is an authentic specimen not a type, the same is *Gypsophila repens* L. n. 579. 1 in (LINN), the rest of the material under *Gypsophila repens* L. n. 579. 2 belongs to *Gypsophila patrini* Ser.; *Gypsophila repens* L. n. 579. 3 is *Gypsophila uralensis* Lessing.

Geographic distribution: Europe: Pyrenees, Auvergne, Alps, Jura, Apennines, Carpathian Mts., Transsylvania, Poland.

FRANCE: Hte. Savoie, Samoens, Stud. Biol. Rheno-Trai. (1949) 290 (U); Pyrenees: Col du Tourmalet, Pitard s.n. 1903 (L); Mt. Llaurenti, Endress s.n. 1830 (L). SWITZERLAND: Valais, above Findelen, Goudet s.n. 1891 (L). TIROL: Bez, Batzak s.n. 1952 (L).

b. var. *archetypa* Murr, Allg. Bot. Zeit. 12: 176 (1906).

Stems 25–55 cm high; inflorescence lax, paniculate, with about 50 fls., leaves larger than in the type variety, 1.5–3 cm long and 1–3 mm broad, acute.

Type: Austria: Tirol, slopes above Kronmetz, J. Murr s. n. (KR not seen).

Geographic distribution: France (Haute Savoie), Austria (Tirol), Italy (Friuli).

FRANCE: Haute Savoie, near Fer à Cheval, Stud. Boil. Rhena-Trai. (1949) 33 (U). AUSTRIA: Kitzbühler Alpen, Heiligenblut, Jeanper 20 (L). ITALY: Friuli, Mt. Gemona, Contardo s.n. 1949 (L).

c. var. *alpigena* Brügg., Zur Fl. Tirols in Zeitschr. Ferd. Must. 3. Folge, 4. Heft: 326 (1860).

Heterotypic synonyms: *G. repens* L. var. *prostrata* Borbás ex Hallier-Wohlf., Kochs Syn. 1: 326 (1892). Type: Reichenbach, Ic. 6: tab. 211. f. 5001 (1844)!; *G. alpestris* Jord. et Fourr. Brev. Fl. Nov. fasc. 1: 9 (1866). Type: Cult. in Hort. Paris from seeds collected from the Alps (P not seen); *G. repens* L. var. *alpestris* (Jord. et Fourr.) Rouy. et Fouc., Fl. Fr. 3: 156 (1896). Type: the same as that of the preceding.

Misapplied names: *G. prostrata* auct. non L., Reichenbach, Fl. Germ. excursoria 801 (1823), Icon, 6: tab. 211, f. 5001 (1844); All., Pedem. 2: 78 (1785); DC., Prod. 1: 354 (1824).

Plants thickly cushion-shaped; root thick, woody; stems 10–20 cm high, prostrate or ascending at the base; leaves 1–3.5 cm long, 1–2.5 mm broad, obtuse; flowers less numerous than in the type variety and larger; petals contiguous, rotundate, white to pink; styles longer than the stamens.

Type: Austria: Oberinntal, between Ried and Pfunds, Brügger s.n. (G not seen).

Geographic distribution: Germany (Isar valley, Harz); France (Haute Savoie, Jura); Switzerland (Engelberg, Jura); Austria (Salzburg, Tirol); Italy (Tirol); Spain (Pyreneés).

GERMANY: Isar valley, near Munich, Reichenbach n. 391 (L); Harz, near Werl, van Soest s.n. 1912 (L). FRANCE: Haute Savoie, Fer à Cheval, J. W. Palibine s.n. 1908 (L); Jura, Lamberze s.n. (L). SWITZERLAND: Engelberg, Gerschialp, Stud. Biol. Rheno-Trai. (1946) 344 (U); Jura, Mt. Colombier before Geneva, Bernet s.n. 1886 (L). AUSTRIA: Salzburg, along the river Salzach, Eysn 2047 (L). TIROL: near Lienz, Vetter s.n. 1909 (L). ITALY: Tirol, Oudemans s.n. (L); Mt. Campione, Damen s.n. 1859 (L). SPAIN: Pyrenées, Cartanesa, Bourgeau 230 (L).

d. var. *montana* Reichenbach, Fl. Saxon. 438 (1842), Icon. fig. 50001 left; Borbás u. Wohlf. in Hallier-Wohlf., Kochs Syn. 1: 326 (1892).

Heterotypic synonym: *G. repens* L. f. *pienina* Zapalow., Fl. Gall. 3: 100 (1906); Ascherson u. Graebner, Syn. Mitt. Fl. 5 (2): 238 (1929).

Stem 20–30 cm high; inflorescence laxer and taller than in the type variety; leaves 1.5–3.5 cm long, 1–2.5 mm broad; flowers red to pink; stamens violet.

Type: Reichenbach from Germany, Isar valley near Munich (may be destroyed), Reichenbach, Icon. 6: tab. 211, fig. 5000 left (1844).

Geographic distribution: very rare in Isar valley near Munich, Germany.

3. Section *Ensifoliae* Barkoudah sect. nov. p. 38

12. *G. caricifolia* Boissier, Diagn. ser. 1 (I): 14 (1842); Bornm., Beih. Bot. Centralb. 32 (II): 362 (1914). Parsa, Fl. de l'Iran 1 (2): 1029 (1951); Bornm., Magyar. Bot. Lap. 30: 61 (1931). Boissier, Fl. Or. 1: 549 (1867).

Heterotypic synonym: *Silene caricifolia* (Boiss.) Bornm. in Verh. d. Z. B. G. Wien 60: 82 (1910). Type: Turkey: Azerbaijan, Knap s.n. (B. destroyed).

Plate II, Fig. 33–39. p. 63

Root about 1 cm thick, bearing a rosette of leaves and few flowering stems; stem erect, glabrous, 20–40 cm high, branching one to three times in the upper part, internodes 5–8 cm long; basal leaves long-ensiform, with long-acuminate apex and broadened base, 3- or pluri-nerved, 5–12 cm long and 2–5 mm broad, the cauline ones smaller; inflorescence capitate, terminal and axillary, 1–2 cm in diam., pedicel shorter than the calyx or absent, calyx amply campanulate, 4–5 mm long and as wide, with ovate, mostly apiculate lobes, with calciumoxalate crystals along the veins; petals cuneate, one and a half times as long as the calyx, retuse or sinuate at the apex, white or pink; stamens nearly as long as the calyx; ovary ovoid with erect, slightly incurved styles; stigma terminal; ovules about 12; capsule as long as the calyx, quadrivalved, mostly with two seeds; seeds 2 mm long, 2 mm broad, with small flat tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

A mountain plant, growing especially along streams, at 500–2500 m alt.

Type: Iran: Küh-e-Alwand, Aucher-Eloy 542. Holotype (G-Boiss.) isotype (K).

IRAN: Nebawend, Mt. Küh-e-Garrah, Strauss s.n. 1908 (JE), Mt. Küh-e-Kuhrud, Strauss (BORNMÜLLER 1914); Azerbaijan: Küh-e-Sahand, Seitlitz (PARSA 1951). IRAQ: Distr. MRO: Warshanka-Magar range, Rawi and Serhang 42321 (K).

13. *G. acantholimoides* Bornmüller, Mitteil. Thüring. Bot. Ver. 23: 1 (1908); Beih. Centralb. 32: 362 (1914).

Plate II, Fig. 40–48. p. 63

A ball of spiny leaves from which few flowering stems arise; stems glabrous, terete, 20–30 cm high; internodes about 3 cm long; leaves spiny, semicircular in cross-section, 1–3 cm long and 1–1.5 mm thick, with a broadened base; inflorescence a rich panicle of twice compound dichasia, pedicel rigid, to 8 mm long, but mostly as long as or shorter than the calyx; calyx short-campanulate, 3 mm long and as wide, with ovate mucronate lobes; petals oblong, the claw mostly broader than the limb, truncate or shallowly emarginate, about one and a half times as long as the calyx, pink; stamens mostly included and unequal, with a glandular swelling at the base; ovary

ovoid, with about 16 ovules; styles divergent and exerted; capsule as long as the calyx, mostly with two seeds; seeds 1.5 mm long, 1 mm broad, with small flat tubercles. Fl. Jun., fr. Jul.

On arid hills.

Type: Iran: Between Sültañabad and Kashan near Shek-ab, Th. Strauss s.n. Isotypes (E, JE), holotype (B destroyed).

Geographic distribution: Endemic to E. Iran.

This species was placed by Bornmüller in the section *Pseudo-acanthophyllum* Boiss. which is excluded in this work from *Gypsophila* and united with *Acanthophyllum*. But, although it resembles *Acanthophyllum* in its spiny leaves and general habit, it differs clearly from it in the following points: The inflorescence is a rich dichasial panicle, not more or less capitate as in most *Acanthophyllum* species; the calyx is short-campanulate, cleft, not toothed; the petals have a broad claw; the styles are divergent with terminal stigma; the capsule is deeply four-valved; the seeds are reniform, compressed on both sides, not oblong, as in *Acanthophyllum*.

#### 14. *G. graminifolia* Barkoudah sp. nov.

Plate II, Fig. 49–54. p. 63

Perennis, dense caespitosa; radice ca. 1 cm crassa; caulibus 2–3, erectis, teretibus, glaberrimis, glauco-viridibus, dimidio superiore ramosis, dichotomis vel trichotomis, 30–80 cm altis; foliis lineari-ensiformibus, 3–5-nerviis, glaucescentibus, anguste acuminatis, basi longe (2–4 mm) connatis, 2–6 cm longis et 3–5 mm latis; inflorescentiis laxè paniculato-dichasialibus, floribus multis; bracteis ovatis, acuminatis, membranaceis; pedicellis usque ad 8 mm longis, calyce longioribus; calycibus late-campanulatis, 3 mm longis, ad medium partitis, lanciniis ovatis, mucronatis; petalis roseis, oblongis, apice emarginatis vel retusis, basi angustatis, 4.5 mm longis et 1.5 mm latis; staminibus petalis fere aequilongibus, basi in glandem incrassatis; ovario oblongo-ovoideo; stylis brevibus; ovulis 8. Fl. Jul.

In serpentino-lapidosis alpinis, ca. 2700 m alt.

Type: Turkey: Wilayet Van. Distr. Basskale: Ispiriz Dag, Davis 23675 (O. Polunin). Holotype (E), isotype (K).

This species is very similar to *Gypsophila caricifolia* Boiss. The general habit, the shape of the leaves, the calyx, and the ovary are nearly identical in both species. However, the inflorescence of *G. graminifolia* is paniculate-dichasial, not capitate, the pedicel is mostly longer than the calyx, the calyx is smaller than in *G. caricifolia*, the petals are emarginate, not sinuate, the styles are shorter, the stamens are glandular-swollen at the base, the ovules are 8, not 12. The areas of these two species are contiguous, *G. graminifolia* occupying the northern end of the area of *G. caricifolia*. It is quite possible that originally these two species were one and that one of them is the ancestor of the other. When comparing their characters one finds that *G. caricifolia* is more specialised than *G. graminifolia*, and it seems likely that the common ancestor was closer to *G. graminifolia* than to *G. caricifolia*.

On the other hand *G. graminifolia* shows some resemblance to *G. acantholimoides* Bornm. Though the general habit is clearly different, the inflorescence and the flower morphology have much in common. The geographical distribution points also to affinity between these two species. Yet, *G. graminifolia* can easily be recognised by having non-spinose, long leaves, by the long pedicel, and by the number of ovules.

#### 4. Section *Corymbosae* Barkoudah p. 39

Subsection A. *Plumosae* Williams p. 39

15. *G. altissima* L.

*Saponaria calycibus pentaphyllis* etc., L., Hort. Uppsal. 107 (1748). *Gypsophila foliis lanceolatis subtrinerviis* L., Nova Pl. Gen. 41 (1751). *Gypsophila altissima* L., Sp. Pl. I 407 (1753); Fenzl in Ledeb., Fl. Ross. 1: 289 (1841); DC., Prod. 1: 352 (1824); *Lychnis caule dichotomis* Gml., Fl. Sib. 4: 143, t. LX. (1769); Bunge, Arbeit. Naturf. Ver. 1 (II): 180 (1848); Williams, Journ. of Bot. 27: 325 (1889).

Homotypic synonym: *Gypsophila altissima* var. *elongata* Ledeb., Fl. Alt. 2: 127 (1830); *Arrostia altissima* (L.) Raf., Car. G. 53 (1810); Raf., Fl. Tellur. 1: 54 (1836).

Heterotypic synonyms: *Gypsophila tianschanica* Popov and Šiškin, Ind. Sem. Hort. Bot. Almat. Acad. Sc. U.S.S.R. 2: 12 (1935), Komarov, Fl. U.S.S.R. 6: 750 and 891 (1936). Type: Kazakhstan: Alatau, upper Czilik at the source of Czurizak river, Popov, M. s.n. 10: 8 (1934) (LE not seen). *G. ucrainica* Kleopov in Komarov, Fl. U.S.S.R. 6: 748 (1936). Type: Ukraine, near Kiev, Bordilowski, E. s.n. 9 VIII (1909) (LE not seen).

Plate III, Fig. 1-7. p. 73

Root thick, 5-15 mm; stems 3-10, ascending, 30-80 cm high, glabrous below, glandular-pubescent above (rarely completely glabrous: f. *glabra* Blocki, O. B. Z. 36: 321 (1886); var. *glabra* Blocki in Zapalow, Consp. Fl. Gall. 3: 103 (1906)), branching in the upper part; leaves oblanceolate to linear-oblanceolate, acute to subobtuse, 1.5-8 cm long and 3.5-12 mm broad, subtrinervate; inflorescence dense; bracts ovate-acuminate with ciliate edge; pedicel 2-5 mm long, glabrous; calyx 2.5-3 mm long, with ovate, rounded, ciliate lobes; petals oblong, white, shallowly emarginate, up to one and a half times as long as the calyx; stamens as long as petals or shorter, ovules 8-12; capsule slightly longer than the calyx; seeds 1.5 mm long, 1 mm broad, with acute tubercles. Fl. Jun.-Jul., fr. Jul.-Aug.

On steppe meadows, chernosem meadows, and on weedy, sometimes rocky, often calcareous hills, rarely in thin pine-forests.

Type: The specimens named *Gypsophila altissima* L. (n. 579, 10, 11, 12 of the Linnean herbarium) are only authentic specimens.

Geographic distribution: U.S.S.R.: (Ukraine: Podolia, Bukowina; Caucasus; Lower Volga; Galicia; Kazakhstan: Uralsk, Alatau, Altai; Great Russia: South Ural, Tomsk, Tobolsk, Upper Lena; Kirgisian Rep.: Dzongaria), Romania, Mongolia.

GALICIA: near Okna, Blocky 1940 (BR, JE, K, W). ALTAI: Bunge (M). UPPER LENA: Augustinoviz s.n. (P). CAUCASUS: Herb. Acad. Petr. (E, P). KAZAKHSTAN: Alatau, V. Michaliva s.n. 1937 as *Gypsophila tianschanica* Pop. and Šiškin, determined by M. Popov (LE).

16. *G. litwinowii* K. Poliyansky, Sched. Herb. Fl. Ross. 8: 61 (1922); Šiškin in Komarov, Fl. U.S.S.R. 6: 751 (1936).

Root thick (ca. 1 cm); stems several, flowering and leafy, erect or slightly ascending at the base, 30-50 cm high, branched, glabrous below, glandular-hairy in the upper part; leaves linear to linear-oblanceolate, 2-4.5 cm long and 2-5 mm broad, acute, with



narrowed base, sometimes obscurely trinervate; inflorescence a loose panicle of dichasia, glandular-pubescent; bracts ovate-acuminate, mostly with ciliate edge, pedicel 2–3 mm long, glabrous; calyx short-campanulate, 1.5–2 mm long, with ovate, obtuse, ciliate lobes; petals white, linear, nearly twice as long as the calyx, with rounded apex and narrowed base; stamens as long as or slightly longer than the petals; ovary globose with long divergent styles, stigma terminal, oblong (as in *G. paniculata* L.); ovules 8; capsule globose; seeds brown. Fl. Jul.

On steppe and hills, calcareous soil.

Type: U.S.S.R.: Great Russia: Prov. Voronezh, distr. Semlyansk near Vislik, Koso—Poliyansky s.n. Holotype (LE not seen); isotype (BM).

Šiškin (1936; p. 751) states that after verbal communication with D. I. Litvinov he was informed that this species was described from aberrant specimens which grew in a special, unnatural habitat, and that it is not a separate species but a form of *Gypsophila altissima* L. In my opinion this is not so. Its characters are not those of typical *Gypsophila altissima*, but rather a combination of *Gypsophila altissima* and *G. paniculata* L. The loose inflorescence, the pedicel, the shape of the calyx, petals, ovary, stigma and the number of the ovules are characters that agree with *G. paniculata*. Since both *G. paniculata* and *G. altissima* occur in the area from which this species was described, the possibility of hybrid origin should be considered.

17. *G. cephalotes* (Schrenk) Williams, Jour. of Bot. 27: 323 (1889).

Basionym: *Gypsophila fastigiata* var. *cephalotes* Schrenk, Enum. Pl. Nov. 1: 92 (1841); Ledeb., Fl. Ross. 1: 200 (1841); Franchet, Sci. Nat. ser. 7 Bot. 15: 238 (1883); Šiškin in Komarov, Fl. U.S.S.R. 6: 752 (1936).

Heterotypic synonym: According to Šiškin *Gypsophila planifolia* H. Winkl., Kjoeb. Vidensk. Meddel. 48 (1901) is a syn. of this species. Type: Pamir: along the river Karasu, Paulsen, O. 749 (LE not seen).

Plate III, Fig. 8–15. p. 73

Stem thicker than in the preceding species, mostly with hollow pith, 3–15 mm thick, 10–50 cm high, glabrous except for the inflorescence, branched; leaves oblong to linear-ob lanceolate, 3–7 cm long, 3–10 mm broad, subtrinervate; inflorescence dense, glandular-hairy; pedicel as long as the calyx or slightly longer, glabrous; bracts lanceolate, acuminate, mostly with sinuate margin; calyx campanulate-turbinate, 2.5–3.5 mm long, with rounded, mostly sinuate lobes; petals oblong, retuse to shallowly emarginate, 1.5 times as long as the calyx; stamens longer than the petals; ovary obovoid, with short erect styles; ovules 24; capsule as long as the calyx; seeds 1.5 mm long, 1.5 mm broad, with small flat tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

On alpine and subalpine meadows and hills.

Type: Middle Asia: Dzungarian Alatau, source of the river Tentak, Schrenk (LE not seen).

Geographic distribution: U.S.S.R. (West Siberia, Altai; Middle Asia: Alatau, Tian Shan, Turkestan, Pamir-Alai, Trans-Alai); India (Chitralh).

U.S.S.R.: West Siberia: ALTAI, Bunge s.n. (P), *ibid.*, Ledebour s.n. (P); *ibid.*, Grisebach (FI). Middle Asia: ALATAU, on the river Sarshan, Karelin and Kirilof 1275 (BM, K, M, P, W); *ibid.*, Karakal, Regel s.n. (K); Tian Shan, V. F. Brotherus s.n. (G); along the river Ili, Krassnow s.n. (E, K, G); TURKESTAN: Mishatab to Margab, Capus 200 and 201 (W); *ibid.*, Fetissow s.n. (K); *ibid.*, Sairam, Regel s.n. 1878 (FI); Seravshan Mts., Taiman, Ovczinnikov and Slobodor 1180 (LE); E. PAMIR: Alicour river basin, Varibtseva and Kuznetsov 602 (LE); TRANS-ALAI: Stanbig steppe, near Muskulak, Rickmers s.n. (M). INDIA: Chitralh: Baroghil pass D. A. Stainton 2992 (BM, W). This plant is much lower than in the other collections (10 cm), not branched, the inflorescence is denser, the number of ovules is 18–20.

This species is very similar to *Gypsophila altissima* L., but differs by its thick stem, broader, sinuate bracts, larger calyx and sinuate not ciliate lobes; the calcium-oxalate crystals are smaller and less numerous in the parenchyma; the ovules are 20–24. Geographically these two species are also very close and it is quite possible that they have a common origin.

Note: Of *Gypsophila saligna* Schrad., Ann. Sc. Nat. Ser. 2, 6: 99 (1836), in Lirnaea 10: 110 (1836) and in Ind. sem. Hort. Acad. Göttin. (1834), *Gypsophila jaligna* Walp., Rep. 2: 776 (1843) (sphalm. pro *G. saligna* Schrad.). I saw a specimen in (BR) noted: *Gypsophila saligna* Sem. H. Bot. Gött. 1837 which was identical with *Gypsophila cephalotes* (Schrenk) Williams; in Herb. Fischer in Götting. there is a specimen which is *Gypsophila altissima* L. In his description, Schrader says „floribus polygamis”; this shows that his plant was an aberrant specimen without taxonomic significance.

#### 18. *G. fastigiata* L.

*Polygonum majus erectum angustifolium, floribus candidis* Mentzel, pug. t. 2, f. 2, (1682). *Saponaria calycibus pentaphyllis, corymbis fastigiatis* ... etc. L., Fl. Suecica 126 no. 346 (1745), Öland Gothl. Resa (1745). *Gypsophila foliis lanceolatis-linearibus obsolete triquetris laevibus obtusis secundis* L., Nova Pl. Gen. (prop. Chenon) 42 (1751). *Gypsophila fastigiata* L., Sp. Pl. 1: 407 (1753); Fenzl in Ledeb., Fl. Ross. 1: 299 (1841); *Gypsophila fastigiata* L. in Zapalow., Consp. Fl. Gall. 100 (1906) with all the forms and varieties; Šiškin in Komarov, Fl. U.S.S.R. 6: 747 (1936); Rchb., Ic. Fl. Germ. 6: t. 241 (1844).

Homotypic synonym: *Saponaria fastigiata* (L) Lam. Fl. France 2: 541 (1778).

Heterotypic synonym: *G. pulposa* Gilib., Fl. Lithuan. 2: 153 (1781). Type: Gilib. from Lithuania (not seen).

Plate III, Fig. 16–23. p. 73

Root thick, woody; stems several, ascending, 5–70 cm high, glabrous below, glandular-hairy in the inflorescence, branched in the upper part; leaves linear to linear spatulate, 1–8 mm long and 1–4 mm broad, obtuse; inflorescence dense; pedicel as long as the calyx, glabrous; bracts ovate, acuminate; calyx campanulate, 2.5–3 mm long, with ovate, obtuse, mostly ciliate lobes; petals cuneate, 1.5–2 times as long as the calyx, with rounded apex, white; stamens longer than the petals; ovules about 20; capsule slightly longer than the

calyx; seeds 1 mm long, 1 mm broad, with acute tubercles. Fl. Jun.-Jul., fr. Jul.-Aug.

On calcareous rocks, sandy soil and in pine forests.

a. var. *fastigiata* Stem 5-25 cm high, glandular-pubescent above; leaves linear, 1-2 mm broad.

Type: L. H. 579, 15 (LINN), Recorded Type loc. Gotland.

Geographic distribution: U.S.S.R. (Karelia, Lapland, Ladozhskoye (Ladoga), Il'men, along the Dnepr river, Estonia, Mophilew, Leningrad, Pskow, Minsk, Caspian Sea); Romania (Transsylvania); Hungary (Central part, near Budapest); Czechoslovakia (Moravia, Bohemia); Austria (Northern part); Germany (Berlin, Thüringen, Mainz, Rheingau); Italy (North Italy); Yugoslavia (Croatia, Dalmatia?); Poland (Olkusz, Galicia); Sweden (Gotland, Öland, Mora); Finland (South and North Finland).

SWEDEN: Öland, Kastlösa, Lunda, Sterner 794 (W); Gotland, Bogevik, Zetterstedt s.n. 1872 (BR). POLAND: Stary Olkusz, Olkusz; Kielce, Błaszczuk, Kostrakiewicz, Konás and Tacik 410 (L). LAPPLAND: Imandra lake, Brenner and Laurin 38 (FL).

In the southern and eastern part of the area the plants are taller, with larger leaves, larger flowers, and thicker indument of hairs. The habitat is also slightly different; in the South and East it is always sandy soil, while in the North it grows on rocks and mountain slopes. But the differences are not pronounced and the two forms pass into each other in the central part of the area.

b. var. *arenaria* (Waldst. and Kit.) Fries, Novit. Fl. Suec. ed 2: 116 (1828). Basionym. *Gypsophila arenaria* Waldst. and Kit. Pl. Hung. 1: 40 t. 41 (1802).

Plants higher than 25 cm, viscid glandular-hairy in the upper part, leaves 2-4 mm broad, flowers larger than in the type variety; mainly on sandy soil.

Type: Waldst. and Kit. Pl. Rar. Hung. 1: t. 41 (1802).

SWEDEN: Gotland, Otverberg s.n. 1896 (M). ESTONIA (U.S.S.R.): between Steden and Riga, Uvelev s.n. 1954 (W). FINLAND: Turku, Säskylä, Lindberg 618 (W). POLAND: near Wrocław, Engler s.n. 1862 (W). BELORUSSIYA S.S.R.: Minsk, Paczoski s.n. 1892 (M). GREAT RUSSIA: Arkhangelsk, Kola Peninsula, Niman 52 (W); Leningrad, S. W. of Luga, Borisova s.n. 1952 (W). GERMANY: near Berlin, Köpenick, Behrendsen s.n. 1886 (L, U); near Mainz, Buy s.n. 1847 (W); (Thüringen), Stollberg, Wallroth 392 (L, M). AUSTRIA: near Lassée, Zerny s.n. (W). CZECHOSLOVAKIA: Brno, near Soholince, Weber 1211 (JE). HUNGARY: Englifeld near Budapest, Steinitz s.n. (M). ROMANIA: Transsylvania, Csepel, Laus s.n. 1910 (W). UKRAINE (U.S.S.R.): Upper Dnepr, between Kratin' and Radul', Karofin 747 (W).

19. *G. × digenea* Borbás, Teméz. Füzet 13: 84 (1890); Richt-Grük. Pl. Europ. 2: 334 (1903).

Plate III, Fig. 24-28. p. 73

*Gypsophila paniculata* L. × *G. fastigiata* L.: Stem erect, purplish, branching throughout, 20-60 cm high, glabrous below, glandular-hairy above; leaves linear-lanceolate to linear, narrowly acuminate; inflorescence looser than in *G. fastigiata*, corymbose, pedicel longer

than the calyx, to 4 mm long; calyx 2–2.5 mm long, with ovate, rounded, not ciliate lobes; petals as in *G. fastigiata*; stigma as in *G. paniculata*; ovules only 12; capsule and seeds sometimes present, but seeds not viable (according to personal experiment).

On sandy hill near Budapest, Hungary.

Type: I saw a specimen collected from the type locality and determined by Borbás s.n. (L).

Note: *G. arenaria* var. *hypotricha* Borbás, Fl. Dit. Balant. 399 (1900), may be included under this hybrid, but it could also be the result of a cross between *G. paniculata* var. *hungarica* Borb. and *G. fastigiata*, because of its hairy leaves and lower part of the stem. Exsic. Hungary: Budapest, Borbás 5010 (P).

20. *G. papillosa* Porta, Atti Acc. Rovereto, ser. 3 (XI) fasc. 2: 1 (1905). Based on: *Gypsophila glandulosa* Porta non Walp., Fedde Repert. Nov. Sp. 8: 482 (1910).

Plate III, Fig. 29–36. p. 73

Stock woody; stems several (3–7), erect, 50–80 cm high, branching throughout, purplish-green, completely glabrous, the internodes 2–3 cm long; leaves small, linear-lanceolate, acuminate, narrowed at base, 1–2.5 cm long and 1–2 mm broad; inflorescence dense, glabrous; pedicel shorter than the calyx, to 2.5 mm long; bracts triangular, acuminate; calyx 2–2.5 mm long, with rounded apiculate lobes; petals cuneate, retuse to shallowly emarginate, one and a half to two times as long as the calyx; petals exceeding the calyx; styles long-exserted; ovules 12–16; capsule longer than the calyx, deeply four-valved, purplish inside; seeds 1 mm × 1 mm × 0.5 mm, with obtuse tubercles. Fl. Aug.–Sept., fr. Sept.–Oct.

On dry, stony hills, calcareous soil, 50–200 m alt.

Type specimen: Italy: Verona, near Garda, Porta s.n. 1930, holotype (FI).

Geographic distribution: This species is only known from its type locality and seems to have a very restricted distribution.

ITALV: Venetia: Verona near Garda, Rigo s.n. 1909 (M); *ibid.*, Rigo s.n. 1914 (W, JE); *ibid.*, Rigo 56 (FI); *ibid.*, Rigo s.n. 1908 (FI); *ibid.*, Khek (W); Mt. Pastello, Rigo s.n. 1902 (JE).

This species is often confused with *Gypsophila fastigiata* L., from which it differs by its completely glabrous inflorescence, shorter internodes, smaller lanceolate, acuminate leaves; its apiculate, not rounded calyx lobes, its retuse to emarginate petals, its inside purplish capsule, its 12–16 not 24 ovules and its seeds with obtuse tubercles.

21. *G. struthium* L., *Kali vermiculatum albo flore* Barr. Ic. 64 t. 119 (1714). *Lychnis hispanica*, *Kali folio* . . . , Tourn. Inst. 1: 338 (1719). *Saponaria struthium quae* . . . Loefl. Iter. 73 (1758). Asso, Syn. Strip. Arag. 59 (1779) DC., Prod. 1: 352 (1824). *G. struthium* L., Syst. ed. 10: 1028 (1759).

Heterotypic synonym: *Gypsophila hispanica* Willk., Flora Iber. Halb. 110 (1852); *id.*, Flora 603 (1851). Type: Spain: Aragón,

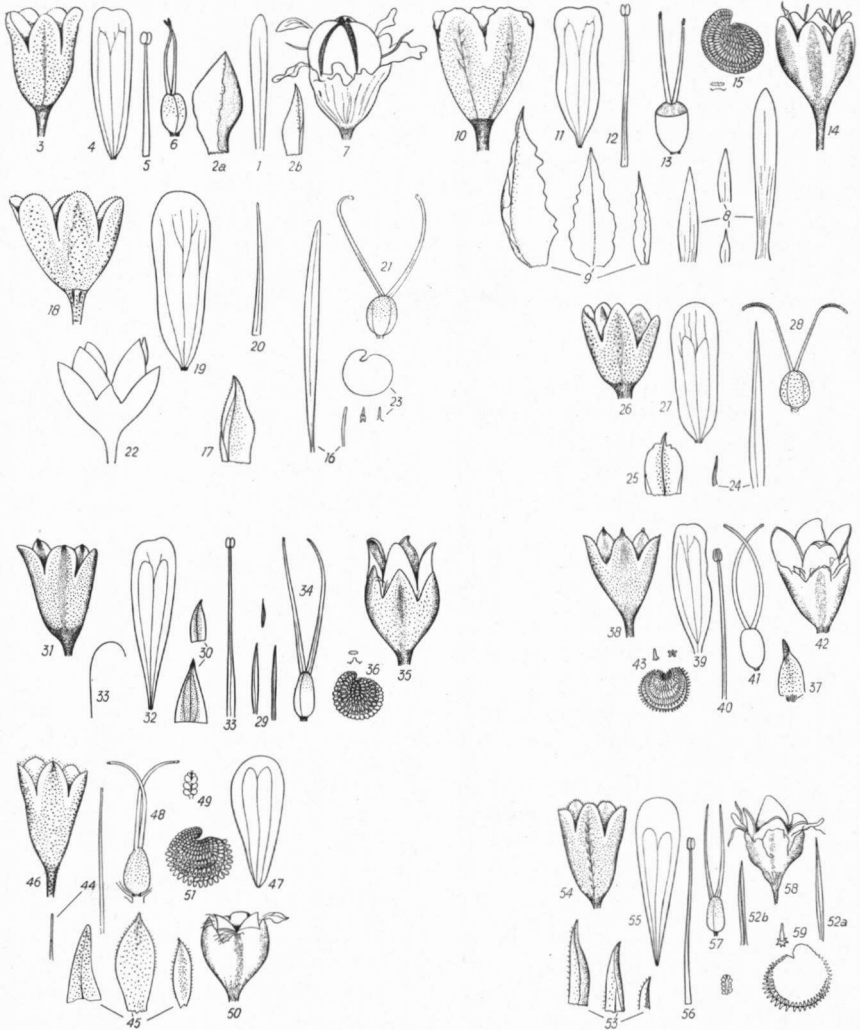


Plate III. Fig. 1-7: *G. altissima*; 1: leaf; 2: bracts; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule. Fig. 8-15: *G. cephalotes*; 8: leaves; 9: bracts; 10: calyx; 11: petal; 12: stamen; 13: ovary; 14: capsule; 15: seed and its tubercles. Fig. 16-23: *G. fastigiata* var. *arenaria*; 16: leaves; 17: bract; 18: calyx; 19: petal; 20: stamen; 21: ovary; 22: capsule; 23: seed and its tubercles. Fig. 24-28: *G. X digenea*; 24: leaves; 25: bract; 26: calyx; 27: petal; 28: ovary. Fig. 29-36: *G. papillosa*; 29: leaves; 30: bracts; 31: calyx; 32: petal; 33: stamen; 34: ovary; 35: capsule; 36: seed and its tubercles. Fig. 37-43: *G. struthium*; 37: bract; 38: calyx; 39: petal; 40: stamen; 41: ovary; 42: capsule; 43: seed and tubercles. Fig. 44-51: *G. iberica*; 44: leaves; 45: bracts; 46: calyx; 47: petal; 48: ovary; 49: placenta; 50: capsule; 51: seed. Fig. 52-59: *G. collina*; 52: leaves; 53: bracts; 54: calyx; 55: petal; 56: stamen; 57: ovary; 58: capsule; 59: seed and its tubercles.

between Alagon and Borja, Willkomm 386. Holotype (M not seen); isotype (M).

Plate III, Fig. 37-43. p. 73

Stock woody; stems several, 20-50 cm high, glabrous, branching in the upper part, whitish to glaucous; leaves linear, subulate or flat, obtuse, mostly with short shoots or leaf bundles in the axil, 1-2.5 cm long and 1-2 mm broad; inflorescence dense, subcapitate; pedicel to 2.5 mm long; bracts ovate, apiculate, with a ciliate edge; calyx circa 2 mm long, with ovate apiculate lobes and ciliate edge; petals cuneate, one and a half times as long as the calyx, with round to shallowly emarginate apex; stamens longer than petals; ovules 16; capsule longer than the calyx, deeply four-valved; seeds 1 mm  $\times$  1 mm, with narrow acute tubercles. Fl. Jul., fr. Aug.

On arid calcareous hills, up to 1000 m alt., rarely on river banks.

Geographic distribution: Spain (Asturia, Catalonia, Madrid, Aragón and Mancha); Andorra.

Type: Spain: Prov. Mancha, Loeffling (not seen, may be lost?). *Gypsophila struthium* L. 579. 14 (LINN) and n. 579. 13. is an authentic specimen.

S.E. ANDORRA, de Wit s.n. 1952 (L). SPAIN: Aragón: between Magallon and Borja, Willkomm. 396 (M), prov. Teruel, Sennen 874 (JE), *ibid.*, Reverchon 755 (K, L, P, W), and 3219 (JE, P), *ibid.*, Pau s.n. 1892 (FI), along the river Manzarena, Pau 2715 (FI, K, M); Catalonia: Balaguer, Hemols s.n. 1871 (BR, W); Lérida, Werner Rauh 154 (M); Madrid, Jaranna, Jeronimo s.n. 1917 (BR) Mancha, along the river Manzarena, Pau 28 (FI, JE, K, M).

Note: Willkomm misinterpreted Linnaeus' description and attached the name *Gypsophila hispanica* to the species *Gypsophila struthium*

22. *G. iberica* Barkoudah spec. nov. *Gypsophila struthium* auct. non L.; Willk., Strand- u. Stepp. Iber. Halbin. 109 (1852), and Willk., Prod. Fl. Hisp. 3: 674 (1880), Willk., Veget. der Erde 1: 149, f. 6 (1896).

Plate III, Fig. 44-51. p. 73

Caudex lignosus; caulibus numerosis, glabris, 30-100 cm altis, ramosis, albis; foliis linearo-subulatis, acutis, 1-5 cm longis et minus 1 mm latis, fasciculis foliorum axillaribus; inflorescentia terminali, capitata, ca. 1 cm in diam.; bracteis triangularibus vel ovatis, apiculatis, ciliatis; pedicellis 1.5 mm longis vel brevioribus, glanduloso-pubescentibus; calycibus 2.5-3 mm longis, laciniis ovatis, rotundatis, ciliatis; petalis oblanceolatis, rotundatis, calycem medio superantibus, patentibus; staminibus petalis longioribus; ovario ovoideo, stylis longis, exsertis, incurvatis, ovulis ca. 12; capsula calyce aequilonga; seminibus ca. 1 mm  $\times$  1 mm, acute tuberculatis. Fl. Jul.-Aug., fr. Aug.-Sept.

Arid, calcareous hills, rarely along river banks, up to 500 m.

Type: Spain: Granada: on river banks between Ceuva and Almería, Bourgeau 1332 Holotype (W); isotype (FI).

Geographic distribution: Spain: Granada, New Castilia, Aragón and Catalonia.

New Castilia: Aranjuez and Rivas, Reuter s.n. 1801 (FI, K, P, W), *ibid.*, Willkomm 26 (G, K); Aragón near Zuera, n. of Zaragoza, Stud. Biol. Rheno-Trai. (1951) 1534 (U); Catalonia: plain of Sierra de Pauf, Dubon s.n. 1843 (FI).

This species is very similar to *Gypsophila struthium* L., but differs by having a taller stem, narrower leaves, capitate inflorescence, obovate bracts, glandular-hairy pedicel, rounded calyx lobes, rounded petals, not very acute seed tubercles. At the same time, the similarity and overlapping geographic distribution of the two species points strongly to a common origin.

23. *G. collina* Stev. ex Ser. in DC., Prod. 1: 352 (1824); *Gypsophila struthium* auct. non L.; Fenzl, in Ledeb., Fl. Ross. 1: 295 (1842); Komarov, Fl. U.S.S.R. 6: 748 (1936).

Homotypic synonym: *Gypsophila fastigiata* ssp. *collina* (Stev.) Schmalh., Fl. Mittel- u. Süd-Russl. 1: 131 (1895).

Heterotypic synonym: *Gypsophila dichotoma* auct. non Bess.; *G. arenaria* var. *leioclados* Borb., Termez. Füz. 13: 84 (1890). Type: Romania: Transsylvania, Mediasch, Richter Barth. s.n. 9 (1884) (W). Plate III, Fig. 52–59. p. 73

Stock woody, prostrate; stems several, 20–60 cm high, glabrous, dichotomously branched in the upper part, leaves linear to narrowly lanceolate, acuminate, 2–4 cm long and 1–2 mm broad; inflorescences dense, glabrous; pedicel mostly shorter than the calyx, 2–3.5 mm long; bracts triangular-acuminate, ciliate; calyx 2–2.5 mm long, ovate-rotundate, ciliate; petals oblanceolate, one and a half to two times as long as the calyx; stamens longer than petals; ovules 16; capsule slightly longer than the calyx; seeds over 1 mm × over 1 mm, with narrow acute tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

On stony and dry hills.

Type: U.S.S.R.: Ukraine: around Odessa, Steven. Holotype (LE not seen); Isotypes (K, P).

Geographic distribution: U.S.S.R. (Ukraine: Middle Dnepr, Black Sea region, Crimea, Southern Bug, Chernovtzy, Moldavia), Romania (Transsylvania).

UKRAINE: near Odessa, Lang and Szovits 48 (L), *ibid.*, Schumann s.n. (JE), Cherson reg., near Kifoniv Nicolaiew, Paczoski s.n. 1888 (W); *ibid.*, Thedosev s.n. 1895 (LE); *ibid.*, A. A. Yanata s.n. 1906 (LE). PODOLIA: near Czerna, Schmalhausen s.n. 1887 (W). MOLDAVIA: near Kagul, Zelenetzuz s.n. (W); near Dojdan, Kleopov 1934 (LE); Dnepr, T. Y. Bilik 1934 (LE). ROMANIA: Transsylvania, Mt. Mediasch, Barth s.n. 1894 (FI, B).

This species differs from the related species *Gypsophila fastigiata* L. by having shorter internodes (2–3 cm), narrowly lanceolate-acuminate leaves, completely glabrous inflorescence and acutely tubercled seeds.

What Besser described in Fl. Gal. Aust. 1: 372 (1809) as *Gypsophila dichotoma* seems to me to be *Gypsophila fastigiata* rather than *Gypsophila collina*, though the type is lost. I saw a specimen collected by Schults in Podolia as *G. struthium*, but is belonged to *Gypsophila fastigiata* L.; the inflorescence is glandular-hairy and the pedicel may reach a length of 1 cm. For this reason I find it confusing to refer the name of the just mentioned to *Gypsophila dichotoma* Bess. as ŠIŠKIN (1936) did.

Subsection B. *Caespitosae* Boissier p. 39

24. *G. oldhamiana* Miquel, Ann. Mus. Bot. Lugd. Bat. 3: 187 (1867).

Plate IV, Fig. 1–8. p. 80

Stock thick, woody; stems several (3–8), 50–100 cm high, glabrous, branching above dichotomously and trichotomously; internodes 2–6 cm long; leaves oblong-lanceolate, acute, narrowed at the base, trinervate, 2–6.5 cm long and 2–8 mm broad; inflorescences corymbose, dense; bracts ovate, caudate or apiculate, mostly with ciliate edge; pedicel mostly as long as the calyx, to 4 mm long; calyx turbinate, 2.5–3 mm long, with ovate, apiculate, mostly ciliate lobes; petals linear, cuneate, up to twice as long as the calyx, pink, with rounded apex; stamens as long as the petals or shorter; ovary obovate, styles long, parallel; ovules 12; capsule slightly longer than the calyx, seeds over 1 mm  $\times$  over 1 mm, with obtuse tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

On rocks and stony slopes, up to 1500 m alt.

Type: Korean Archipelago, Oldham 76. Holotype (L), isotypes (FI, M).

Geographic distribution: China (Hopeh, Shansi, Shantung, Honan, Shensi, Kiang-su, Nan-Hwei, Sheking, Kwang-tung, Gehol); Mongolia (E. and C.); Manchuria (Mukden); Korea (Seoul, Korean Archipelago).

Economical use: This species is reported to be used as vegetable by the local population.

CHINA: Kwang-tung, Hong Kong, Balfour, I.B. s.n. 1910 (E); Jehol, A. David s.n. (P, K). EAST MONGOLIA: Tartarun, David 2097 (P). KOREA: Seoul, E.T. Dunn 482 (K).

This species differs from the related *Gypsophila altissima* L. by its completely glabrous, higher stem, its oblong, clearly trinervate leaves, its larger calyx with apiculate lobes, and its rounded petals.

25. *G. ellipticifolia* Barkoudah sp. nov.

Plate IV, Fig. 9–14. p. 80

Perennis, suffruticosa, glabra; caulibus numerosis, procumbentoadscendentibus, ca. 2 mm crassis et 15–20 cm altis, superne ramosis, internodiis 3–4 cm longis; foliis ellipticis, acutissimis, ad basim angustatis et connatis, 2–3 cm longis et 3–6 mm latis; inflorescentia ad basim trichotoma, superne dichasialis, plus minusve corymbosa; bracteis triangularibus, caudatis, scariosis; pedicellis 5–15 mm longis; calycibus campanulatis, 4–5 mm longis et 4 mm latis, ad medium partitis, laciniis ovatis, acuminatis, margine late scariosis; petalis albis, calyce duplo longioribus, et 2–2.5 mm latis, cuneatis, rotundis, ad basim angustatis; staminibus exsertis, petalis brevioribus; ovario ovoideo, stylis parallelis staminibus aequilongibus, ovulis 8–10.

Type: China: Ngan-Hwei: Po-hua-shan, Schindler 75. Holotype (E), isotypes (BM, K).

CHINA: Ngan-Hwei, Po-Hua-shan, Schindler 181 (BM, E, R), North, Hemeling



206(E); *ibid.*, Tatarinow s.n. 1839 (K); *ibid.*, Fischer (K); Kiang-Su: Tai hoa chan, R. P. Licent 3121 (P); Hopei: Lai-Yuan-Hsien, K. M. Lion 2652 (K).

This species differs from *Gypsophila oldhamiana* Miq. by having narrower and smaller leaves, a lower stem, looser inflorescence, not ciliate bracts and lobes, its larger calyx with acuminate lobes, and white, broad petals with a shallow contraction between the limb and the claw. From *Gypsophila davurica* Turcz. it differs by having longer stems, shorter leaves, round petals, 8–10 (not 16) ovules.

Note: It is quite possible that what J. Krause described in Fedde Repert. Beih. 12: 364 (1922) as *Gypsophila tschiliensis* Krause is the same species. But the type of *Gypsophila tschiliensis* Krause was destroyed in Berlin during the war, and to my knowledge there is no isotype extant. On the basis of the description alone the identity of *G. tschiliensis* cannot be established with certainty.

26. *G. davurica* Turczaninow ex Fenzl in Ledeb., Fl. Ross. 1: 294 (1842). *Gypsophila dahurica* (orth. mut. for *davurica*) Siškin in Komarov, Fl. U.S.S.R. 6: 768 1936).

Homotypic synonym: *Gypsophila gmelini* var. *dahurica* Turcz. Fl. Baic.-Dahur. 1: 201 (1842); *Gypsophila acutifolia* var. *dahurica* (Turcz.) Rgl. in Bull. Soc. Nat. Mosc. 34: 539 (1861).

Plate IV, Fig. 15–21. p. 80

Root woody, thick (ca. 1 cm); stock woody; stems (3–10) several, glabrous, 40–80 cm high, white-green or purplish, branched in the upper third; leaves linear-lanceolate, long-acuminate, narrowed at the base, 1.5–6 cm long and 2–7 mm broad; bracts lanceolate, caudate to acuminate, mostly ciliate; pedicel up to 6 mm long, mostly shorter than the calyx; calyx 3.5–4 mm long, with ovate, acuminate lobes, mostly ciliate, ribs thick, with dense calcium-oxalate crystals in the parenchyma; petals oblong, twice as long as the calyx, light pink, truncate to emarginate, with a shallow contraction between the limb and the claw; stamens shorter than the petals; ovary ovoid, with long-exserted incurved styles, ovules 16; capsule slightly longer than the calyx; seeds over 1 mm  $\times$  over 1 mm, with acute tubercles on the back. Fl. Jun.–Jul., fr. Jul.–Aug.

On steppe grassland and dry stony hills.

Type: U.S.S.R.: East Siberia: Dauria, near Nerschinsk, Turczaninow s.n. Holotype (LE not seen); paratypes: Dauria, Turczaninow s.n. 1831 (FI, K), *ibid.*, at the south of Pogromeszens, Basnin s.n. 1828 (G.).

Geographic distribution: U.S.S.R.: (East Siberia: Dauria), Manchuria: (Hilokiang, Jehol), Mongolia, China: (Kan-su, Szechuan).

DAHURIA: Nertschinsk, Karo 198 (BM, E, G, JE, L, M, P). CHINA: Kansu: near Lanchow, Cling 240 (E). MONGOLIA: 10 km W. of Tabo-ol mount., Andersson 397 a. (E).

Note: Regel in Bull. Soc. Nat. Mosc. 34: 539 (1861) reduced *Gypsophila squarrosa* Tausch, Flora 1: 241 (1831), to a synonym of *G. davurica*. As far as I can deduce from the description, it is quite feasible that these two names apply to the same species. But there is

no type specimen or any other authentic material of *Gypsophila squarrosa* which was described from a garden plant (Hort. Prag.), and it is impossible to confirm this suspicion.

27. *G. patrinii* Seringe in DC., Prod. 1: 353 (1824); *Lychnis gypsophila foliis linearibus axillaribus confertis teretibus* Gmel., Fl. Sib. 4: 144 n. 41, t. 61, f. 1 (1768).

Homotypic synonym: *Gypsophila gmelini* Bunge var. *patrinii* (Ser.) Bunge in Ledeb., Fl. Ross. 2: 128 (1830); *G. gmelini* Bunge in Ledeb., Ic. Pl. Fl. Ross. Atl. illustr. 5: t. 402 (1834); Fenzl in Ledeb., Fl. Ross. 1: 293 (1842); *Gypsophila gmelini* var. *patrinii* Turcz. and var. *intermedia* Turcz., Fl. Baic.-dahur. 1: 200-201 (1842); *Gypsophila acutifolia* Fisch. var. *gmelini* Rgl., Bull. Soc. Nat. Mosc. 34: 536 (1861).

Plate IV, Fig. 22-29. p. 80

Root thick, woody, (5-10 mm); stock woody; stems several (3-15), erect, 20-60 cm high, completely glabrous; leaves linear-lanceolate, 1-6 cm long, 2-5 mm broad, acuminate; inflorescence loose; pedicel 5-20 mm long; bracts triangular-acuminate, mostly ciliate; calyx campanulate, 2.5-3.5 mm long, with ovate acute to obtuse lobes, mostly ciliate; petals oblong-cuneate, retuse to shallowly emarginate, 2-3 times as long as the calyx; stamens shorter than the petals; ovary ovoid, with long divergent styles; ovules 12-16; capsule as long as the calyx; seeds over 1 mm long, over 1 mm broad, with flat tubercles. Fl. Jun.-Jul., fr. Jul.-Aug.

On dry hills, on stony soil and on rocks on river banks.

a. var. *patrinii*: Leaves flat, not triquetrous, 2-3 mm broad; inflorescence lax.; pedicel to 1 cm long.

Type: U.S.S.R.: Kazakhstan: Ustkamenogorsk, along the river Irtysh (G-Del).

Geographic distribution: U.S.S.R.: (Volga-Kama: South Ural, Vyatsk, Chalilova; West Siberia: Altai, Irtysh; East Siberia: Angaria, Sayan, Dahuria, Lena-Kola; Middle Asia: Balkhash region, Dzungaria, Tarbagatia, Tian-Shan, Pamir-Alai). Mongolian Rep.; Manchuria.

DAHURIA: Turczaninow s.n. (M); along the river Angara; Turczaninow s.n. (M). ALTAI: Bunge s.n. (M, P). TARBAGATAI-DZONGARIA: Schrenk s.n. (BR). CENTRAL KANSU: Yellow river basin between Taosha and Lanchow, J. F. Rock 13236 (E). MONGOLIA: A. David s.n. (P).

b. var. *caespitosa* (Turcz.) Šiškin in Komar., Fl. U.S.S.R. 4: 767 (1936). Basionym: *Gypsophila gmelini* Bunge var. *caespitosa* Turcz., Fl. Baic.-Dahur. 1: 200-201 (1842).

Plants 5-15 cm high, densely caespitose; leaves linear, triquetrous; inflorescence dense; pedicel less than 5 mm long.

Type: Dahuria Transbaical, Bunge 62 (G).

Geographic distribution: U.S.S.R. (W. Siberia: Altai; Middle Asia: Dzungaria; E. Siberia: Transbaical reg.); China (Kansu).

c. var. *thesiifolia* (Ser.) Šiškin in Komar., Fl. U.S.S.R. 6: 767

(1936). Basionym: *Gypsophila thesiifolia* Ser. ex DC., Prod. 1: 354 (1824).

Homotypic synonym: *G. gmelini* Bunge var. *thesiifolia* (Ser.) Bunge in Ledeb., Fl. Alt. 2: 128 (1830); Turcz. in Fl. Baic.-Dahur. 1: 200-201 (1842).

Leaves linear, triquetrous, not flat, about 1 mm broad, bracts caudate, inflorescence lax; pedicel to 1 cm long.

Type: around Chamanikh? in Herb. Deless. (G not seen).

Geographic distribution: U.S.S.R. (W. Siberia: Altai; E. Siberia: Dahuria; Mongolia; Middle Asia: Transbaikal reg., Dzungaria; Turkmenia).

ALTAI: along the river Irtysh, G. N. Potanin s.n. 1876 (P).

Note: This species is polymorphous and widely distributed. It shows many similarities with several other species of this group.

28. *G. pacifica* Komarov, Bull. Jard. Bot. Petr. 16: 167 (1916).

Heterotypic synonym: *Gypsophila perfoliata* var. *latifolia* Maxim., Prim. 52 (1859); Komar., Act. Hort. Petr. 22: 206 (1912). Type: Manchuria: along Amur river, Maximowicz (K, P, U).

Plate IV, Fig. 30-37. p. 80

Root thick, woody; stems few, 60-100 cm high, glabrous, branched in the upper part, internodes 2-4 cm long; leaves ovate, clasping, acute to obtuse, 3-6 cm long and 1.5-3.5 cm broad, with five or more veins; inflorescence lax; pedicel to one cm long, mostly about 6 mm long; bracts triangular, acuminate, mostly ciliate; calyx 2.5-3 mm long, with ovate, rounded lobes, mostly ciliate; petals oblong, about twice as long as the calyx, pink, with rounded apex and narrowed base; stamens shorter than the petals; ovary ovoid, with long divergent styles; ovules 20-24; capsule slightly longer than the calyx; seeds 1.5 mm × 1.5 mm, with obtuse tubercles. Fl. Aug.-Sept., fr. Sept.-Oct.

In rock crevices and on rocky slopes, along the shore of lakes and the sea.

Type: Valley of the river Rakovka, mouth of the river Tâodena, Komarov (LE not seen).

Geographic distribution: U.S.S.R. (Western Siberian Coast between 40° and 50° N. lat.); Manchuria.

MANCHURIA: along the river Zesur, Maximowicz s.n. (BM, K); distr. Ninonta: river Mudan-dsian, Komarov 641 (F1); RSFSR: Prov. Ussaria near Possieta, Komarov 641 (BM, K, P), on the shores of Hanka lake, Bohnhof 223 (E, K, P); *ibid.*, Pozenvatki s.n. (BM); Manchurian coast, C. Wilford s.n. 1859 (B, K, P); Kirin: near Chingpohu, Kung 21100 (K). CENTRAL ASIA: Chaffanjon 1589 (P).

29. *G. preobrashenskii* Czerniakowska, Not. Syst. Herb. Hort. Petrop. 3: 126 (1922); misapplied name: *Gypsophila gmelini* var. *caespitosa* auct. non Turcz., Fl. of Western Tyan-Shan 1: 456 (1904); Act. Hort. Petr. 13: 208 (1904); Fedčenko, Pl. of Turkestan 1: 15 (1905).

Plate IV, Fig. 38-44. p. 80

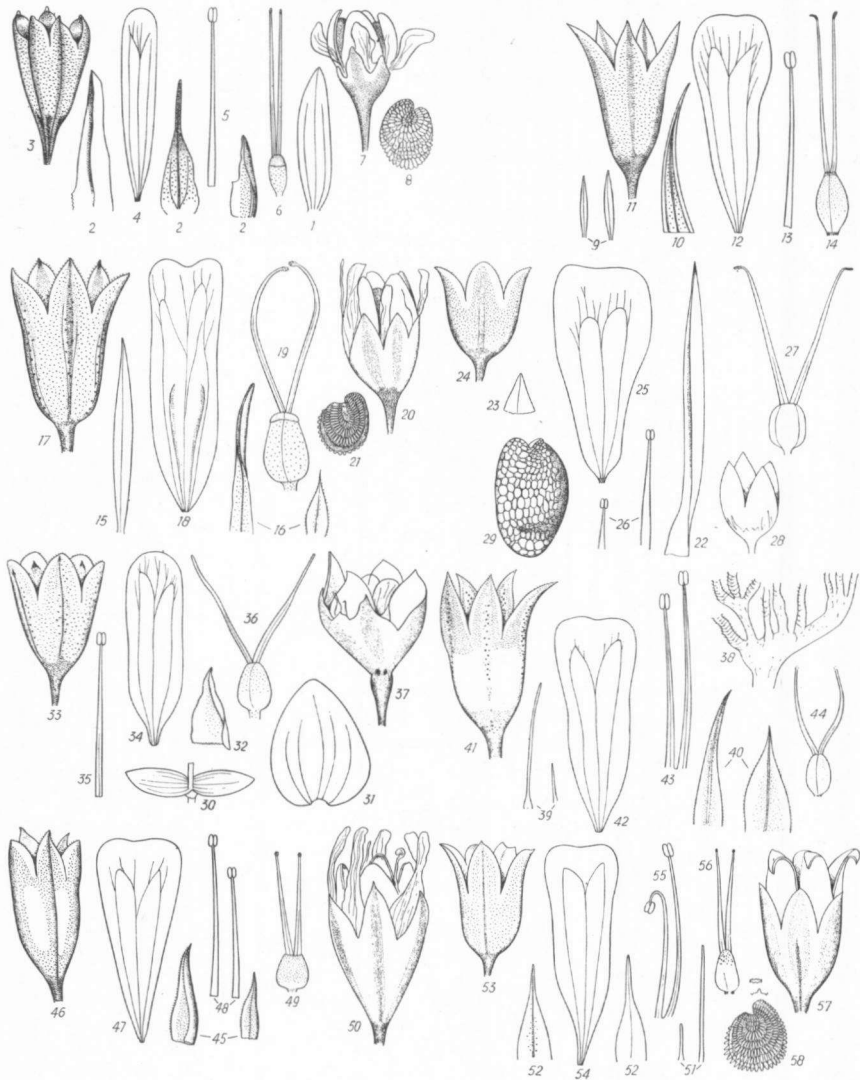


Plate IV. Fig. 1-8: *G. oldhamiana*; 1: leaf; 2: bracts; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed. Fig. 9-14: *G. ellipticifolia*; 9: leaves; 10: bract; 11: calyx; 12: petal; 13: stamen; 14: ovary. Fig. 15-21: *G. davurica*; 15: leaf; 16: bracts; 17: calyx; 18: petal; 19: ovary; 20: capsule; 21: seed. Fig. 22-29: *G. patrinii* var. *patrinii*; 22: leaf; 23: bract; 24: calyx; 25: petal; 26: stamens; 27: ovary; 28: capsule; 29: seed. Fig. 30-37: *G. pacifica*; 30: node with two leaves; 31: leaf; 32: bract; 33: calyx; 34: petal; 35: stamen; 36: ovary; 37: capsule. Fig. 38-44: *G. preobrashenskii*; 38: caudex; 39: leaves; 40: bracts; 41: calyx; 42: petal; 43: stamens; 44: ovary. Fig. 45-50: *G. licentiana*; 45: bracts; 46: calyx; 47: petal; 48: stamens; 49: ovary; 50: capsule. Fig. 51-58: *G. sambukii*; 51: leaves; 52: bracts; 53: calyx; 54: petal; 55: stamens; 56: ovary; 57: capsule; 58: seed and its tubercles

Plant forming tufts 15–20 cm in diam.; stems 30–50 cm high, glabrous, branched in the upper third; internodes 2–5 cm long; leaves linear, triquetrous, fleshy, acute, with broadened base, 3–6 cm long and 1–1.5 mm broad, cauline leaves shorter; inflorescence dense; bracts lanceolate, caudate, mostly ciliate; pedicel to 7 mm long, mostly shorter than the calyx; calyx campanulate, 4–5.5 mm long, with ovate acuminate lobes, ciliate, with a large number of calcium oxalate crystals in the parenchyma; petals cuneate, one and a half times as long as the calyx, truncate to shallowly emarginate, narrowed at the base; stamens shorter than the petals; ovary ovoid, with short divergent styles; ovules 16; capsule longer than the calyx; seeds with small tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

On rocky hills.

Type: Turkestan: Kirgiz Rep.: Talasski Ala Tau, Keynar valley near Dzildi-Gulata, Preobrashensky (LE not seen).

Geographic distribution: U.S.S.R.: (Pamir-Alai, Tien-Shan).

U.S.S.R.: KIRGIZ rep.: distr. Osh, near Gulcha, Tranzschel s.n. 1900 (LE). ALAI: near Dzokingy, Lipsky 3400 (LE).

30. *G. licentiana* Hand.-Mazz., Oesterr. Bot. Zeitschr. 82: 245 (1933).

Misapplied name: *Gypsophila acutifolia* auct. non Fisch.; Forb. et Hensl., Jour. Linn. Soc. Bot. 23: 64 (1886), nec var. *chinensis* Regel. Plate IV, Fig. 45–50. p. 80

Plant forming tufts; stems 20–40 cm high, glabrous, slender, branched in the upper part; internodes 5–8 cm long; inflorescence dense; leaves linear, very narrow, 1–3 cm long and about 1 mm broad, acute; pedicel longer than the calyx, to 1 cm long; bracts triangular, acuminate, ciliate; calyx 4–5 mm long, incised to one third of its length, with ovate, acuminate lobes; petals triangular, cuneate, one and a half to two times as long as the calyx, truncate to emarginate; stamens shorter than the petals, mostly unequal; ovary ovoid, with short nearly parallel styles; ovules 16; capsule slightly longer than the calyx; seeds not seen. Fl. Jul.–Aug., fr. Aug.–Sept.

On dry stony hills and on rocks.

Type: China: Shensi: between Yunyang and Kaoshan, Licent 7619. Holotype (not seen), isotype (K).

Geographic distribution: China (Kansu, Shensi, Shansi, Hopeh); Mongolia; U.S.S.R. (Tien Shan).

CHINA: KANSU: Trippner 346 (M), Tchang i pév, Licent 4569 (BM, P), Mt. N. Tatung, Licent 174, paratype (K, P). SHANSI: N., Licent 174 (K). SHENSI: Giraldi 204 (FI), Infanto, Giraldi 2623 (FI); N. China, Licent 13765 (P), and 5653 (BM, P). HOPEH: Peking, E La-Traffe, Licent 3121 (BM), W. China, Wilson 3247 (BM); *ibid.*, Hugh 897 (BM). MONGOLIA: W. Mt. Alachan, Przewalski s.n. (P), C. Mongolia, E. Licent 3381 (BM). TYAN SHAN: Ludlow 767 (BM).

This species is very similar to *Gypsophila preobrashenskii* Czern., but in *G. licentiana* the leaves are not broadened at the base, the stem is lower and thinner, the calyx lobes are not long-acuminate, the petals are triangular not cuneate, and the basal leaves are not so densely imbricate as in *G. preobrashenskii*.

31. *G. sambukii* Šiškin in Komar., Fl. U.S.S.R. 6: 763, 892 (1936).  
Plate IV, Fig. 51–58. p. 80

Root thick (ca. 1 cm), bearing many flowering and leafy stems, flowering ones (8–20), 10–20 cm high, glabrous, branched in the upper half; leaves linear, obtuse, 2–6 cm long and ca. 1 mm broad, cauline ones few (3–4 pairs); inflorescence dense; pedicel up to 6 mm long, mostly shorter than the calyx; calyx campanulate, 3.5–4 mm long, with lanceolate acuminate lobes; petals pink-violet, twice to two and a half times as long as the calyx, oblong, shallowly emarginate, narrowed at the base; stamens shorter than the petals; ovary ovoid, with short parallel styles; ovules 16–20; capsule ca. 5 mm, exceeding the calyx; seeds 1.5 mm × 1.2 mm, with acute tubercles on the back. Fl. Jul., fr. Aug.

On bare patches in the arctic part of Siberia.

Type: U.S.S.R.: Siberia: between the river Yenissy and Chatanga, along the river Medveskya, Th. Sambuk (LE not seen).

U.S.S.R.: Bulum reg.: Yakutsk, Ulyuger river near Lena, Mkoroval s.n. 1938 (LE).  
TRANSBAIKAL: Barguzinsk, banks of the river Neruigi, Korotkyi & Lebedeva 450 (LE).

This species differs from *Gypsophila licentian* Hand.-Mazz. and *Gypsophila preobrashenskii* in its lower stems, its densely tufted habit, its obtuse and flat leaves, and its non-ciliate bracts and non-ciliate calyx lobes.

32. *G. capituliflora* Ruprecht, Sert. Tianshan. 40 (1869); Šiškin, Trav. du Mus. Bot. de l'Acad. Sc. de l'U.S.S.R. 24: 34 (1932); Šiškin in Komar., Fl. U.S.S.R. 6: 769 (1936).

Heterotypic synonyms: *Gypsophila pamirica* Preobr., Bull. Jard. Bot. Petr. 16: 181 (1916). Type: U.S.S.R.: Pamir-Alai, Preobrashensky s.n. (LE not seen). *Gypsophila semiglobosa* Czern., Not. Syst. ex Herb. Hort. Bot. Petr. 3: 129 (1922). Type: U.S.S.R.: C. Tien-Shan, Semiredge, Dolina Arpy, R. I. Rozovitz 1910 (LE not seen).

Plate V, Fig. 1–9. p. 85

Root thick, woody; stems several, tufted, 6–25 cm high, glabrous, mostly unbranched; leaves narrowly linear, thick, acute, 1–3 cm long and ca. 1 mm broad; inflorescence terminal, capitate; bracts lanceolate, acuminate, mostly ciliate; pedicel nearly absent; calyx campanulate, 4–5 mm long, with lanceolate acuminate lobes, mostly ciliate; a large number of small calcium oxalate crystals in the parenchyma; petals cuneate, pink to white, about one and a half times as long as the calyx, truncate to shallowly emarginate; stamens as long as the petals, mostly unequal; ovary ovoid, with short styles; ovules 16; capsule as long as the calyx; seeds 2 mm × 1.5 mm, with flat small tubercles. Fl. Jul., fr. Aug.

On stony hills in the alpine zone.

Type: U.S.S.R.: Kirgiz: Tien-Shan, valley of the river Arpa, Ruprecht (LE not seen).

Geographic distribution: U.S.S.R.: (Pamir-Alai, Tien-Shan), China: (Sinkiang: Dzungaria, Kashgaria).

PAMIR: 30 km N. Murgud, Polyakov 396 (LE); Alaysk Mt., Taninas reg., N. P. Gorbunov s.n. 1928 (LE). MIDDLE ASIA: Chaffanjon 1309 (P).

33. *G. mongolica* Barkoudah sp. nov.

Plate V, Fig. 17–21. p. 85

Radix crassa; planta glabra, suffruticosa, caulibus pluribus (3–10), ca. 50 cm altis, superne ramosis, internodiis 2–4 cm longis; foliis linearibus vel lanceolatis, acuminatis, ad basim angustatis, 2–3 cm longis et 2–3 mm latis, nervis salientibus facie dorsali; inflorescentia densa, dichasiali, plus minusve corymbosa; bracteis triangularibus acuminatis, ciliatis, scariosis, pedicellis rigidis 2–3 mm longis; calycibus campanulatis 2–2.5 mm longis et 2 mm latis, ad medium partitis, laciniis ovatis, rotundatis, ciliatis; petalis oblongis, retusis vel leviter emarginatis, ad basim angustatis, calycibus medio superantibus, 1 mm latis; staminibus petalis aequilongibus vel paulo longioribus; ovario globoso, stylis longis divergentibus; ovulis 12.

On dry semidesert plains.

Type: East Mongolia, David 2808. Holotype (P), isotype (BR).

Geographic distribution: Mongolia.

C. MONGOLIA: Pai nobo, R. P. Licent 3381 (P); Gobi, G. N. Potanin s.n. 1884 (E, FI, P).

This species can be compared with *Gypsophila patrinii* Ser. var. *caespitosa* (Turcz.) Šiškin, but the stem is higher, the leaves are shorter and broader, the internodes shorter, the inflorescence denser, the calyx smaller, the petals only slightly longer than the calyx, the ovules only 12. From *Gypsophila licentiana* Hand.-Mazz. it differs by its linear-lanceolate leaves, its denser inflorescence, the much smaller calyx with rounded lobes, the shorter petals, the smaller number of ovules (only 12). In its habitat it differs from both last-mentioned species.

34. *G. uralensis* Lessing, Linnaea 9: 172 (1834); Fenzl in Ledeb., Fl. Ross. 1: 292 (1842); Bunge, Arbeit. Naturf. Ver. 1 (II): 180 (1848).

Homotypic synonym: *Gypsophila uralensis* var. *typica*, Krylov, Trav. Soc. Nat. Kaz. 9: 40 (1881); *Lychni gypsophila foliis linearibus* . . . Gmel., Fl. Sib. 4: 144, t. 61 f. 1 (1769).

Heterotypic synonym: *Arenaria gmelini* Fisch. ex DC., prod. 1: 173 (1824). Type: U.S.S.R.: W. Siberia, along the river Jennissey, Fischer (LE not seen). *G. uralensis* var. *glabra* Krylov, Trav. Soc. Nat. Kaz. 9: 40 (1881). Type: Krylov from Ural Mts s.n. (LE not seen).

Misapplied name: *Gypsophila gmelinii*. auct. non Bunge; Šiškin, Bericht. Tomsk. Abt. Russ. Bot. Gesel. 3: 117 (1930).

Plate V, Fig. 22–27. p. 85

Root thick, woody, bearing a thick tufted cushion of flowering and leafy stems; stems 5–20 cm high, glabrous below, glabrous or glandular-pubescent in the upper part, internodes 2–6 cm; leaves linear-oblongate, narrow, acute to obtuse, 1–5 cm long and 1–2 mm broad, dense at the base of the stem, the cauline ones linear, not narrowed at base; inflorescence trichotomous below, dichasial above, glandular-hairy or rarely glabrous; bracts lanceolate, acuminate, glandular-hairy on the lower surface or rarely glabrous; pedicel up to 6 cm long, mostly longer than the calyx, glandular-hairy; calyx campanulate, 3–4.5 mm long, with oblong, rounded or apiculate lobes, glandular-hairy; scattered calcium oxalate crystals in the parenchyma;

petals white, 2–3 times as long as the calyx, oblanceolate, shallowly emarginate; stamens slightly longer than the calyx; ovary ovoid, with short divergent styles; ovules about 20; capsule as long as the calyx; seeds 1.5 mm × 1.2 mm; tubercles small. Fl. Jun.–Jul., fr. Jul.–Aug.

In rock crevices and on rocky hills, rarely in woods.

Type: Great Russia: Ural, Taganay, Lessing s.n. Holotype (B destroyed), isotype (LE not seen).

Geographic distribution: U.S.S.R.: Ural mountains, Kirgiz SSR and Siberia.

Plate V, Fig. 28–33. p. 85

Komi: Ust'shchugor, Kystar s.n. 1905 (LE); Sverdlovsk reg., near Kumba, B. A. Tichomirov s.n. 1939 (LE); Kumba Mts., K. N. Igosina s.n. 1958 (M); Perm reg.: Werchoturja Mt. in Herb. Schreber (M); along the river Taganay, coll.? s.n. 1844 (FI); Ural Mts., Meinshausen (JE); Celyabinsk reg.: Mt. Iremel, Lehmann s.n. 1840 (P); ibid., Lehmann 182 (P); in Kirgizian desert, Al. Lehmann s.n. (BR); Siberia without precise loc., Pallas (BM).

35. *G. brachypetala* Trautv., Act. Hort. Petr. 2: 471 (1873); Boiss., Fl. Or. Suppl. 85 (1888); Šiškin in Komar., Fl. U.S.S.R. 6: 770 (1936).

Plate V, Fig. 28–33. p. 85

Root woody; stems several, erect, glabrous, 8–20 cm high, branched in the upper part; internodes 2–3.5 cm long; leaves linear, with broadened base and acute apex, 5–6 cm long and 1.5–3 mm broad, scabrous on their border and along the costa; inflorescence dense; bracts lanceolate, acuminate; pedicel as long as the calyx or shorter; calyx campanulate 3.5–5 mm long, with lanceolate acuminate lobes, a small number of small calcium-oxalate crystals in the parenchyma; petals oblanceolate, slightly longer than the calyx to one and a half times as long, emarginate to bilobed, light pink; stamens as long as the petals or slightly longer; ovary ovoid, with long incurved styles; ovules 8–12; capsule slightly longer than the calyx; seeds unknown. Fl. Jul. (Description compiled from the literature cited above).

On south-facing slopes in the alpine zone.

Type: U.S.S.R.: Armenia: Achish-dade mountains near the Turkish boundary, Radde s.n. (LE not seen).

This species differs from *Gypsophila tenuifolia* var. *subcapitata* Rupr. by its higher stem, its broader leaves which are devoid of the typical broad scarious base, scabrous on their border and along the midrib, its acuminate not caudate bracts, and its shorter petals.

36. *G. steupii* Šiškin, Candollea 3: 473 (1928); Komar., Fl. U.S.S.R. 6: 762 (1936).

Plate V, Fig. 10–16. p. 85

Root thick, woody, creeping; stems several, flowering and leafy, 30–40 cm high, erect, glabrous, unbranched or only branched in the upper part; leaves linear, tapering from base to top, 3–10 cm long and 1.5–3 mm broad, the cauline ones shorter, few (4–5 pairs); bracts lanceolate, acuminate; pedicel 4–6 mm long; inflorescence dense; calyx campanulate, 4–6 mm long, with lanceolate acuminate lobes; petals oblanceolate, twice as long as the calyx, shallowly



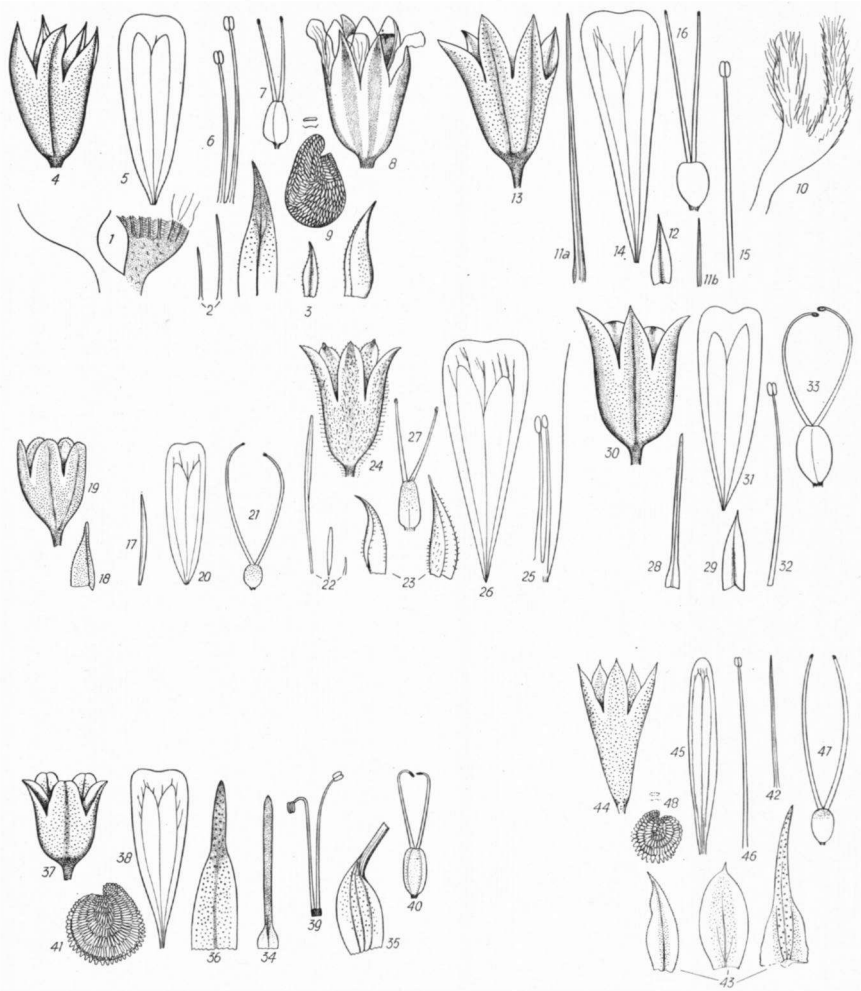


Plate V. Fig. 1-9 *G. capituliflora*; 1: caudex; 2: leaves; 3: bracts; 4: calyx; 5: petal; 6: stamens; 7: ovary; 8: capsule; 9: seed and its tubercles. Fig. 10-16: *G. steupii*; 10: caudex; 11: leaves; 12: bract; 13: calyx; 14: petal; 15: stamen; 16: ovary. Fig. 17-21: *G. mongolica*; 17: leaf; 18: bract; 19: calyx; 20: petal; 21: ovary. Fig. 22-27: *G. uralensis*; 22: leaves; 23: bracts; 24: calyx; 25: two stamens and a petal; 26: petal; 27: ovary. Fig. 28-33: *G. brachypetala*; 28: leaf; 29: bract; 30: calyx; 31: petal; 32: stamen; 33: ovary. Fig. 34-41: *G. tenuifolia* var. *subcapitata*; 34: leaf; 35: leaf base; 36: bract; 37: calyx; 38: petal; 39: stamens; 40: ovary; 41: seed. Fig. 42-48: *G. sphaerocephala* var. *sphaerocephala*; 42: leaf; 43: bracts; 44: calyx; 45: petal; 46: stamen; 47: ovary; 48: seed and tubercles.

emarginate, with narrowed base, white; stamens shorter than the petals; ovary obovoid, with long erect styles; ovules about 16. Fl. Jun.–Jul.

On rocks.

Type: Western Caucasus: along the river Mzymta, W. Steup s.n. 1921 (LE)!

This species differs from *Gypsophila brachypetala* Trautv. by its higher mostly unbranched stems, its longer leaves which are not scabrous, its petals which are twice as long as the calyx, and its 16 ovules. Geographically these two species are also very close.

37. *G. tenuifolia* M. Bieberstein, Fl. Taur. Cauc. 1: 319 (1808); Ser. in DC., Prod. 1: 353 (1824); Fenzl in Ledeb., Fl. Ross. 1: 292 (1842); Boiss., Fl. Or. 1: 539 (1867); Rupr., Fl. Cauc. 177 (1869); Šiškin in Komar., Fl. U.S.S.R. 6: 762 (1936).

Heterotypic synonym: *Arenaria pulchra* Willd. ex Schlecht., Ges. Naturf., Fr. Berl. Mag. 7: 212 (1816). Type: Caucasus: Mt. Ararat, Adams s.n. (B-Willd.)!

Plate V, Fig. 34–41. p. 85

Root thick, woody; stems several (5–20), glabrous, unbranched below the inflorescence, slender; leaves aggregated at the base of the stem, linear with broadened base and acute apex, up to 10 cm long and 1–1.5 mm broad, the basal ones with broadly scarious base (5 mm × 5 mm), the cauline ones shorter and smaller; inflorescence loosely dichasial to capitate; pedicel absent or up to 22 mm long; bracts lanceolate, acuminate to caudate, scarious; calyx campanulate, 4–5 mm long with ovate, obtuse or apiculate lobes; petals oblanceolate, two or three times as long as the calyx, 2–3 mm broad, shallowly emarginate, narrowed at the base, white to pink; stamens shorter than the petals; ovary ovoid, with short styles; ovules 12; capsule slightly longer than the calyx, seeds 1.5 × 1.5 mm, with acute tubercles on the back. Fl. Jun.–Jul., fr. Jul.–Aug.

On rocks, rocky soil, and alpine meadows.

a. Var. *tenuifolia*: Leaves often 5–10 cm long, 1–1.5 mm broad; inflorescence lax; pedicel longer than the calyx.

Type: Caucasus: Kasbek, M. Bieberstein. Holotype (LE), isotype (B-Willd.)!

Geographic distribution: U.S.S.R.: (Caucasus, E. Transcaucasia), N.E. Turkey.

CAUCASUS: Kuban, between Do-Ut and Ulšakulan, S. Sommier and E. Levier s.n. 1890 (FI). DAGESTAN: Mirzojeva 137–16 (W); Mt. Elburz along the river Kükürtli, S. Sommier and E. Levier s.n. 1890 (FI); M. Kyatsaey, Selkovnikov and Schmidt s.n. 1908 as *G. tenuifolia* var. *gracilipes* Woronov. (LE). TRANSCAUCASIA: Mt. Kuvira, Alboff 37 (P).

b. Var. *subcapitata* Ruprecht, Fl. Cauc. 177 (1869).

Heterotypic synonym: *Gypsophila tenuifolia* var. *squarrosa* Šiškin in Komarov, Fl. U.S.S.R. 6: 762 (1936). Type: no type or any other material is cited.

Leaves up to 5 cm long, 1 mm broad; inflorescence denser than

in the type var.; pedicel as long as the calyx or shorter.

Type: N.W. Caucasus, along the R. Kassut, Meyer (LE not seen).

Geographic distribution: U.S.S.R. (Transcaucasia); E. Turkey.

TRANSCAUCASIA, G. Woronov and W. Steup s.n. 1927 (LE). TURKEY: Wilayet Çoruh (Artvin), Savval Tepe above Murgul, Davis & Hedge D. 32278 (E, K).

##### 5. Section Capituliformes Williams p. 40

38. *G. sphaerocephala* Fenzl ex Tchihat., *Asie Min. Bot.* 1: 205 (1860); Boiss., *Fl. Or.* 1: 548 (1867).

Plate V, Fig. 42-48. p. 85

Root thick, woody; stock woody; stems several (3-7), erect, rigid, whitish-glaucous, glabrous, 30-70 cm high, with few branches or unbranched, internodes 3-7 cm long; leaves linear, flat or triquetrous, narrowly acuminate, 1-6 cm long and 1-2 mm broad; inflorescences capitate, flower capitules terminal and axillary, about 1 cm diam.; bracts ovate, acuminate, the basal ones caudate, mostly ciliate; calyx turbinate, 3.5-5 mm long, with ovate acuminate lobes, mostly glabrous; petals linear, to one and a half times as long as the calyx, with rounded apex and narrowed base, white to pink; stamens as long as the petals or longer, spreading; ovary globose to obovoid, with long styles; ovules 8; capsule as long as or slightly shorter than the calyx; seeds 1.5 mm  $\times$  over 1 mm, with acute tubercles on the back. Fl. Jul.-Aug., fr. Aug.-Sept.

On dry rocky hills, 500-2000 m alt.

a. Var. *sphaerocephala*: Stem 30-50 cm high; leaves mostly triquetrous, 1-2 mm broad; flower capitules about 1 cm diam.; bracts and calyx glabrous or with scattered hairs.

Type: S. E. Turkey: Wilayet Van: Mt. Kara Dag, Kotschy 318, Holotype (G), isotypes (FI, P).

Geographic distribution: Central, South and East Turkey, N. Iraq, Rhodes (Greece).

TURKEY: Wilayet Antalya: Elmali, Bourgeau 41 (E, G, K, L, P); *ibid.*, Lavanoir s.n. 1911 (M); near Ceipatzar, Pichler 99 (G, K); Wilayet Konya: distr. Ermenek, Hamitseydi bogay-Beshuyu, Davis 16255 (E); Sara near Ermenek, Peronin 167 (P); at the source of Irmak Gous, Bolkar Daglari, Kotschy 357 B (G, P); Wilayet Adana: Ala Daglari, Ellenberg 122 (B); Wilayet Maras: Elbistan, Davis 20429 (K). GREECE: Rhodos: near Slakos, Bourgeau s.n. 1870 (K). IRAQ: Lewaa El-Mosul: between Dohuk and Al'Ahmadiya, Rechinger (W); Al'Ahmadiya, Grant and Scindale 64 (P).

b. Var. *cappadocica* (Boiss. et Bal.) Boissier, *Fl. Or.* 1: 548 (1867); Basionym: *Gypsophila cappadocica* Boiss. et Bal. in Boiss., *Diagn. ser.* 2 (VI): 26 (1859); Šiškin in Komarov, *Fl. U.S.S.R.* 6: 747 (1936).

Heterotypic synonym: *Gypsophila exaltata* Bornm., *Magyar. Bot. Lap.* 30: 61 (1931); *Fedd. Repert. Beihefte* 89: 102-105 (1940). Type: Turkey: Wilayet Ankara, distr. Çankiri, Cakmakli-dere, Bornmüller 13330 (B destroyed).

Plants mostly higher than in the type var., 50-70 cm, leaves flat, 2-2.5 mm broad, flower capitules 1-1.5 cm in diam., bracts and calyx glandular-pubescent.

Type: Turkey: Wilayet Keyseri: Aslandag, Balansa 1053. Holotype (G), isotype (P).

Wilayet Tunceli: Munzur dag, above Ovacik, Davis & Hedge D. 31472 (E); Wilayet Erzincan: Kuruçay, Haussknecht 2988 (JE); Wilayet Bitlis: Adilcevaz, Davis 24605 (O. Polunin) (E, K).

39. *G. pilulifera* Boissier et Heldreich in Boiss., Diagn. ser. 1 (VIII): 56 (1849); Boiss., Fl. Or. 1: 548 (1867).

Plate VI, Fig. 1-8. p. 91

Stock woody, stems several, slender, glabrous, 30-60 cm high; branched a few times towards the top; internodes 3-4 cm long; leaves subulate, acute, 3-5 cm long and about 1 mm broad, mostly 1.5 cm long; inflorescence capitate, mostly long-pedunculate; flower capitules about 5 mm in diam; basal bracts triangular, the inner ones oblong, apiculate, with some cilia on the edge; calyx campanulate, with rounded apiculate lobes, mostly ciliate, often glandular-puberulent, 2-2.5 mm long; petals linear, up to one and a half times as long as the calyx, and about 0.5 mm broad, with rounded or erose apex; capsule obovoid; seeds very similar to those of the last species. Fl. Jul., fr. Aug.

Along the edges of pine forests and corn fields.

Type: Turkey: near Antalya, Heldreich 1845. Holotype (G), isotype (K, P).

Geographic distribution: Endemic to South West Turkey.

TURKEY: Nevsehir: Nevsehir-Gulsehir (Arapsun), 20 km from Gulsehir, McNeill 376 A (K, W).

As far as known, this species is very restricted in its distribution. It is very similar to *Gypsophila sphaerocephala* Fenzl, also geographically, but its habitat is different. Also it differs by having smaller subulate leaves, always pedunculate, smaller flower-capitules (not more than 5 mm diam.), apiculate bracts, smaller calyx (2-2.5 mm long), with apiculate lobes, narrower petals, fewer ovules (4-8) and an obovoid capsule.

40. *G. syriaca* Šiškin, Candollea 3: 476 (1928).

Plate VI, Fig. 9-17. p. 91

Stock thick, woody, branched; stems numerous (10-30), 10-25 (35) cm high; internodes about 3 cm long; leaves linear, triquetrous, 1-2 cm long; inflorescences capitate, terminal and axillary, ca. 5 mm in diam; bracts ovate, acuminate, sometimes glandular-hairy, especially the inner ones; calyx campanulate-turbinate, 2.5-3 mm long, with scattered glandular hairs, with ovate acuminate lobes; petals one and a half times as long as the calyx, linear, the claw mostly broader than the limb, with rounded apex and narrowed base; stamens longer than the petals, spreading; ovary obovoid, with long styles; ovules 8; capsule as long as the calyx; seeds 1.5 mm × 1 mm, with acute tubercles on the back. Fl. Aug., fr. Sept.

On calcareous rocks, 1500-2500 m alt.

Type: Turkey: Amanus, Mt. Döldük, Haradjian 3860. Holotype (G-Deless.), isotypes (K, W).

Geographic distribution: Endemic to South Turkey.

TURKEY: Wilayet Adana: distr. Baha (Amanus), Didil Dag near Atlik Yoyla, Davis 16360 (E, K); Ala Dag (Taurus), Ellenberg 91 A (B); Wilayet Konya: distr. Ermenek, Harnit seydi bogay-Beskyu, Davis 16255 (K).

This species differs from *Gypsophila sphaerocephala* Fenzl and *G. pilulifera* Boiss. et Held. by its low unbranched stem, sessile flower-capitules, smaller leaves, broadly clawed petals, longer styles and rocky habitat.

41. *G. olympica* Boissier, Diagn. ser. 1 (VIII): 55 (1849); Boiss., Fl. Or. 1: 548 (1867).

Plate VI, Fig. 27–35. p. 91

Caespitose; root thick, woody; stock branched; stems numerous (5–15), 5–10 cm high, erect, unbranched; leaves linear, triquetrous, acute, about 1 cm long and 1 mm broad, only 1–2 pairs of cauline leaves; inflorescence capitate, flower-capitules 1 cm in diam., exclusively terminal, with 3–5 cm long peduncle, sometimes glandular-hairy below the flower capitule, bracts ovate, acuminate to caudate, glandular-ciliate; calyx campanulate-turbinate, glandular-pubescent, 2.5–3.5 mm long, with ovate apiculate lobes; petals linear-cuneate, about one and a half times as long as the calyx, with rounded truncate apex and narrowed base; stamens as long as the petals, spreading; ovary globose-ovoid, styles long, erect, incurved, ovules about 8; capsule as long as the calyx or shorter, deeply splitting into four valves; seeds 1.3 mm  $\times$  1.2 mm, with acute tubercles on the back. Fl. Jul., fr. Aug.

On calcareous rocks, 2000–2500 m alt.

Type: Turkey: Wilayet Bursa: Mt. Ulu Dag (Olympus), Boissier s.n. 1842. Holotype (G. Boiss.), isotype (P).

Ulu Dag (Olympus), Clement s.n. 1850 (Fl, G, K); *ibid.*, R. Maire s.n. 1904 (G); *ibid.*, M. Basarman and A. Metu s.n. (G).

This species differs from the last mentioned species of the sect. *Capituliformes* Williams by its low stem, solitary terminal flower-capitules, mostly glandular-hairy peduncle, glandular-hairy calyx, cuneate petals, and its rocky habitat. At the same time it shows relationship to *Gypsophila transsylvanica* Spreng. In its morphology as well as in its geographical area it is intermediate between the last mentioned Turkish species and *G. transsylvanica* which inhabits the Carpathians.

42. *G. transsylvanica* Sprengel, Syst. 4 Cur. post.: 179 (1827). Based on: *Banffya petraea* Baumg., Enum. Stirp. Magno Transsylvanica 1: 385 (1816); DC., Prod. 1: 255 (1824); Sprengel, Syst. veg. 1: 866 (1825); Dietr., Syn. Pl. 2: 1543 (1852).

Homotypic synonym: *Gypsophila petraea* (Baumg.) Reichb., Fl. Germ. Excurs. 801 (1830–32); Sink, Enum. Fl. Transsylvanica 115 (1886), non Fenzl.

Plate VI, Fig. 18–26. p. 91

Plants cushion-shaped; root woody (3–5 mm diam.); stems numerous, flowering and leafy, with many basal leaves, 3–10 (20) cm high, erect, with at the most 3 pairs of leaves, glabrous below, glandular-puberulent on the last internode, unbranched, with one flower-capitule at the top; leaves linear, 1.5–5 cm long and about 1 mm broad,

cauline ones half as long, flat, obtuse, connate, broadened and scarious at the base; flower capitules ca. 1–2 cm in diam.; bracts ovate, caudate, mostly ciliate; calyx campanulate-turbinate, with ovate, obtuse lobes; petals linear-cuneate, one and a half to two times as long as the calyx, rotundate to shallowly emarginate; stamens shorter than petals, spreading; ovary obovoid, styles long; capsule as long as the calyx, deeply four-valved; seeds 1.5 mm  $\times$  1.3 mm, with acute tubercles on the back. Fl. Jul., fr. Aug.

On rocks and on rocky slopes in the Alpine zone, 1500–2500 m alt.

Type: Romania: Transsylvania, Baumgarten 750. 1840. Neotype (BR). Holotype (B destroyed).

Geographic distribution: S. and E. Carpathian Mountains in Romania and E. Hungary; Rodopi Planina in Bulgaria.

ROMANIA: Pietra arsa, Borza 629 (P, W); Mt. Pietra Mare, Zsaky s.n. 1906 (W); Mt. Barsei, Woelff s.n. 1887 (M, P, W); Siebenbürgen, Vetter s.n. 1918 (W). HUNGARY: Mt. Nagy Hagymás near Balán, Janka s.n. 1868 (FI, JE, P, W).

This species differs from *Gypsophila olympica* Boiss. by its flat, long, obtuse leaves with broadened base, its often distinct pedicel, its glabrous calyx and its longer petals. From other species of the sect. *Capitutumiformes* it is very easy to distinguish. At the same time this species shows relationship to *Gypsophila tenuifolia* M. B. var. *subcapitata* Rupr., which is a member of sect. *Corymbosae* subsect. *Caespitosae* Boiss. The linear leaves with broadened scarious base, the unbranched stem, the calyx, the petals, and the seeds are quite comparable in these two species.

43. *G. capitata* M. Bieberstein, Fl. Taur.-Cauc. 1: 321 (1808); Boiss., Fl. Or. 1: 547 (1867); Rupr., Fl. Cauc. 180 (1869).

Homotypic synonym: *G. glomerata* Pallas var. *capitata* (M. Bieb.) Ser. in DC., Prod. 1: 354 (1824).

Misapplied names: *Gypsophila glomerata*, auct. non Pall.; Adams in Web. et Mohr, Beitr.: 54 (1805), non Pall.

Plate VI, Fig. 36–40. p. 91

Stock woody; stems several, 20–40 cm high, ascending, glabrous, mostly branched a few times; leaves linear, thick, subtriquetrous, acute, 1–3 cm long and about 1 mm broad; flower-capitules terminal, 8–12 mm in diam.; peduncle long; bracts lanceolate, acuminate; pedicel sometimes present, up to 1 mm long; calyx campanulate, 3–3.5 mm long, with ovate rounded lobes; petals linear-oblong, white, about one and a half times as long as the calyx, with rounded apex and narrowed base; stamens shorter than petals; ovary globose, with long incurved styles; ovules 12; capsule as long as the calyx; seeds 1.5 mm  $\times$  1.5 mm, with obtuse tubercles. Fl. Jul., fr. Aug.

On stony hills, calcareous rocks, and on gravel.

Type: Caucasus: Mt. Kurt-Bulak, M. Bieberstein s.n. (LE not seen), a photo of the type (K).

Geographic distribution: U.S.S.R. (Caucasus: Dagestan: E. Transcaucasia: Azerbaijan).

CAUCASUS: Dagestan: Mt. Akhty, Becker 133 (K, P, W) and 132 (BM, P, W); *ibid.*, Alexeenko s.n. 1898 (L).

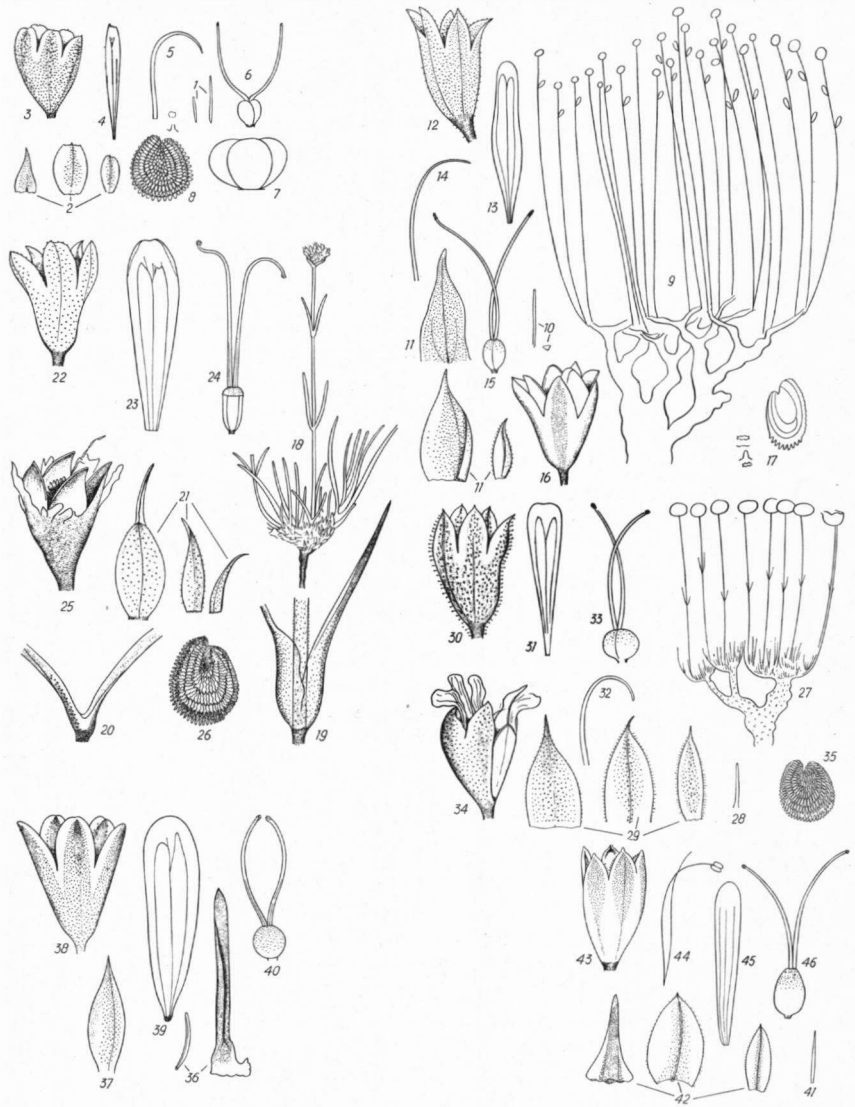


Plate VI. Fig. 1-8: *G. pilulifera*; 1: leaves; 2: bracts; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed and tubercle. Fig. 9-17: *G. syriaca*; 9: a whole plant; 10: leaf and its cross-section; 11: bracts; 12: calyx; 13: petal; 14: stamen; 15: ovary; 16: capsule; 17: seed and its tubercles. Fig. 18-26: *G. transsylvanica*; 18: a whole plant; 19: upper node of a stem; 20: basal part of two leaves; 21: bracts; 22: calyx; 23: petal; 24: ovary; 25: capsule; 26: seed. Fig. 27-35: *G. olympica*; 27: a whole plant; 28: leaf; 29: bracts; 30: calyx; 31: petal; 32: stamen; 33: ovary; 34: capsule; 35: seed. Fig. 36-40: *G. capitata*; 36: leaf; 37: bract; 38: calyx; 39: petal; 40: ovary. Fig. 41-46: *G. lignosa*; 41: leaf; 42: bracts; 43: calyx; 44: longitudinal section of a petal and a stamen; 45: petal; 46: ovary

44. *G. pinifolia* Boissier et Haussknecht in Boiss., Fl. Or. Suppl. 87 (1888).

Plate VII, Fig. 9-17. p. 94

Root thick, woody; stems several, the flowering ones 20-40 cm high, glabrous, thin, rigid, whitish to glaucous, branched a few times in the upper part, internodes 2-4 cm long; leaves linear-aciculate, more or less spiny, semicircular in cross-section, erect, with expanded connate base, basal ones densely imbricate, 7-9 cm long and about 1 mm thick, cauline ones shorter, 3-4 cm long; inflorescences capitate, terminal as well as at the end of short side-branches, flower-capitules to 1 cm in diam.; bracts triangular, acuminate, sometimes with sinuate edge; calyx tubiform-turbinate, 3.5-4 mm long, with ovate, acute to apiculate lobes; petals linear-cuneate slightly exceeding the calyx, white, with rounded apex; stamens as long as the petals or slightly longer; ovary obovoid, with long divergent styles; ovules about 6; capsule nearly as long as the calyx, deeply four-valved; seeds 1.3 mm × 1 mm, with flat tubercles. Fl. Aug., fr. Sept.

On calcareous rocks and rocky slopes, 1000-1500 m alt.

Type: Turkey: Wilayet Malatya: Isaglutdag, Haussknecht s.n. 1865 (JE).

Geographic distribution: Endemic to Central Turkey.

Wilayet Malatya: Elbistan, above Kalaköi, Haussknecht 1094 (JE); Gürüm-Malatya, 65 km from Malatya, McNeill 446 (E, K); Wilayet Karaman: Sara near Ermenek, Péronin 167 (K).

This species, though it is clearly a member of the section *Capituliformes*, shows some similarity to the genus *Acanthophyllum*. The spiny leaves and the tubiform calyx are comparable with those of *Acanthophyllum* species. Yet there can be no doubt about its position and this similarity is more likely attributable to a kind of convergence.

45. *G. lignosa* Hemslow et Lace, Jour. Linn. Soc. 28: 322 (1891); Parsa, Fl. de l'Iran 1 (2): 1029 (1951).

Plate VI, Fig. 41-46. p. 91

Stock thick, woody, branched; stems several (3-10), 20-45 cm high, erect, glaucous, with papillose epidermis, branched in the upper part, internodes 5-6 cm long; leaves linear, flat to triquetrous, 1-2 cm long, about 1 mm broad, acute with papillose epidermis. Flower-capitules terminal and axillary, 5-10 mm in diam.; bracts triangular, caudate at the base of the flower-capitule, ovate apiculate inside, ciliate; calyx campanulate-turbinate, incised to one third of its length or less, with ovate apiculate lobes, the edge involute and ciliate; petals linear-cuneate, as long as to one and a half times as long as the calyx, rotundate, with narrowed base, white; stamens as long or longer than petals, spreading; ovary ovoid, with long spreading styles, ovules 8; capsule unknown. Fl. Aug.

In fissures of calcareous rocks, 2000-3000 m alt.

Type: W. Baluchistan: Mt. Ziarat, Lace 3944. Holotype (E), isotype (K).

Geographic distribution: W. Baluchistan; N. E. Afghanistan, S. E. Iran.



AFGHANISTAN: N. E.: Prov. Kabul: Porande valley, side valley of the river Pandcher near Bazarak, A. Gilli 1240 C. (E).

This species may easily be recognised among other members of the sect. *Capituli-formes* by its wody stock, its subulate terete leaves, its small, involute and ciliate calyx lobes, its long stamens and its ovoid ovary. As the preceding species it shows also some similarity to the genus *Acanthophyllum*.

46. *G. glomerata* Pallas ex Bieb., Fl. Taur. Cauc. 1: 321 (1808); Fenzl in Ledeb., Fl. Ross. 1: 299 (1842); Ser. in DC., Prod. 1: 354 (1824); Boiss., Fl. Or. 1: 547 (1867).

Homotypic synonym: *Petrorhagia glomerata* (Pallas) Link, Handb. 2: 235 (1831).

Plate VII, Fig. 1-8. p. 94

Caespitose; stems (1-5) erect, 20-80 cm high, glabrous, sometimes glandular-pubescent on the upper internodes, branched in the upper part; leaves linear to linear-lanceolate, 2-10 cm long and 1-4 mm broad, glabrous, narrowly acuminate, slightly expanded and connate at the base; flower-capitules terminal, long-pedunculate, 1-1.5 cm in diam.; bracts ovate, those at the base of the flower-capitule caudate, ovate, acuminate, the inner ones sinuate, nearly always ciliate; calyx campanulate-turbinate 3-3.5 mm long, with oblong apiculate lobes, mostly sinuate and ciliate; petals linear-oblong, about one and a half times as long as the calyx, white, with rotundate apex and narrowed base; stamens longer than the petals, spreading; ovary obovoid, with long spreading styles, ovules 8; capsule shorter than the calyx, deeply four-valved; seeds 1.2 mm  $\times$  1 mm, with acute tubercles. Fl. Jun.-Jul., fr. Jul.-Aug.

On calcareous rocks, dry stony hills, rarely on sandy soil.

Type: Crimea, Pallas s.n., Holotype (LE not seen), isotype (BM).

Geographic distribution: U.S.S.R. (Crimea, Caucasus, W. Transcaucasia, S. Ukraine); Bulgaria; Romania.

CRIMEA: between Simferopol and Bakhchisaray, Szowits s.n. Lang Herb. (BR); "Tauria", Steven s.n. (BR). CAUCASUS: C. A. Meyer s.n. (P). S. BULGARIA: Staminaka (Asenovgrad), V. Stribny s.n. 1893 (BR, JE, M, W). ROMANIA: Dobruja: Costanta, Sint 620 (BR, K, P, W); along the river Danube, near Skela Cladovei, Degen 2862 (L, W).

47. *G. globulosa* Steven ex Besser, Flora 15, 2. Beih.: 34 (1832); Boiss., Fl. Or. 1: 547 (1867); Ruprecht, Fl. Cauc. 1: 181 (1869); Komar., Fl. U.S.S.R. 6: (1936).

Homotypic synonym: *G. glomerata* Pallas var. *globulosa* (Stev.) Schmalh., Fl. Mittel. u. Süd. Russland 1: 131 (1895).

Misapplied names: *G. glomerata* auct. non Pallas; Adams in Web. and Mohr, Beitr. 1: 54 (1805); *G. capitata* auct. non M. Bieb., Ledebour, Fl. Ross. 1: 300 (1842).

Plate VII, Fig. 18-27. p. 94

This species differs from the last one by having glandular-hairy viscous upper internodes with sessile glands, much larger bracts with toothed sinuate edge, many nerved, calyx lobes coarsely sinuate never apiculate, and seeds with obtuse tubercles.

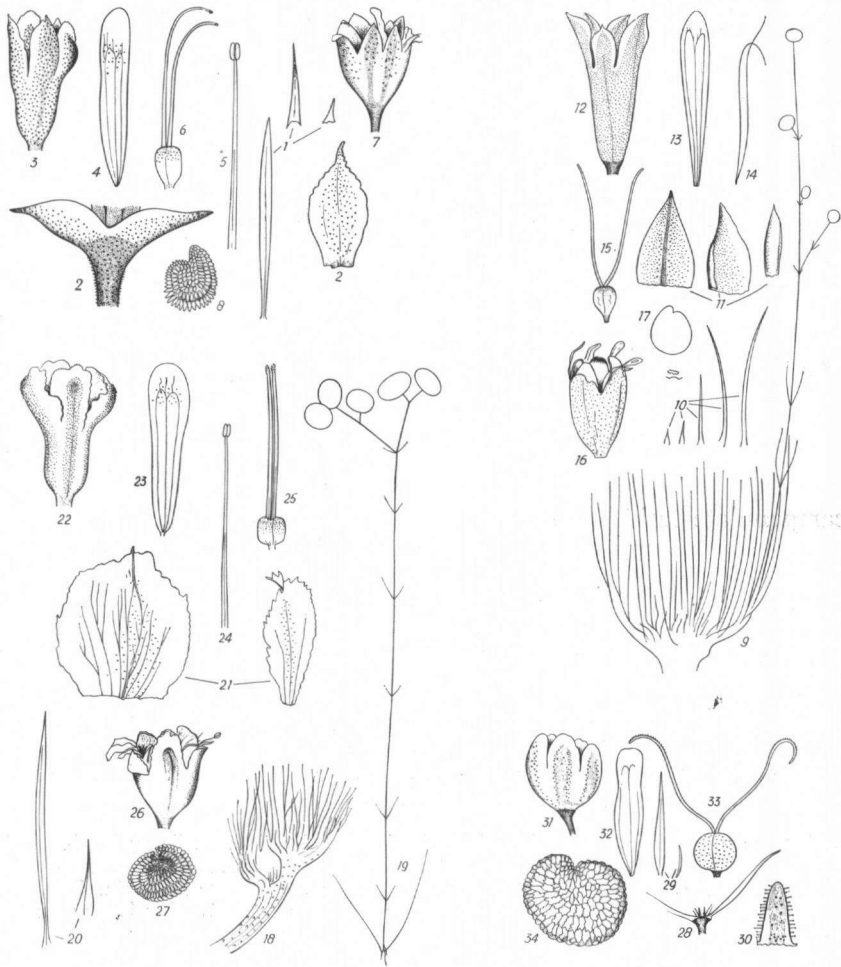


Plate VII. Fig. 1-8: *G. glomerata*; 1: leaves; 2: basal bracts of a capitule; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed. Fig. 9-17: *G. pinifolia*; 9: caudex and a stem; 10: leaves; 11: bracts; 12: calyx; 13: petal; 14: longitudinal section of a petal and a stamen; 15: ovary; 16: capsule; 17: seed and tubercle. Fig. 18-27: *G. globulosa*; 18: caudex; 19: stem; 20: leaves; 21: bracts; 22: calyx; 23: petal; 24: stamen; 25: ovary; 26: capsule; 27: seed. Fig. 28-34: *G. paniculata* var. *adenopoda*; 28: node and its two leaves; 29: leaves; 30: bract; 31: calyx; 32: petal; 33: ovary; 34: seed

On rocks and on rocky calcareous hills.

Type: U.S.S.R.: Caucasus, Steven s.n. Holotype (LE not seen). In Kew there is a sheet with specimens collected by Steven, but it is mixed with *Gypsophila glomerata* Pallas.

Geographic distribution: U.S.S.R. (Black Sea region and the Caucasus Mts.).

CAUCASUS: Fischer s.n. (FI, L); near Pyatigorsk, Hohenacker s.n. 1842 (L, M, P, W). TAURIA (Crimea), Steven s.n. (P). UKRAINE: Taganrog, Schmalhausen s.n. 1887 (W). Lower Volga: Sarepta, Zeleatzy s.n. 1874 (W).

## 6. Section *Paniculaeformes* Williams p. 40

### Subsection A. *Paniculatae* Boissier p. 41

#### 48. *G. paniculata* L.

*Gypsophila foliis lanceolatis scabris, corollis recurvatis* L., Nova Pl. Gen. (prop. Chenon) 41 (1751); *Gypsophila paniculata* L., Sp. Pl. 1: 407 (1753); Fenzl in Ledeb., Fl. Ross. 1: 297 (1842), in part: Reichb., Ic. Fl. Germ. 6: tab. 242 (1844); Komar., Fl. U.S.S.R. 5: (1936).

Homotypic synonyms: *Arrostia paniculata* (L.) Raf., Car. gen. 35 (1810); *Saponaria paniculata* (L.) Neumayer, Oester. Bot. Zeit. 91: 236 (1942).

Plate VII, Fig. 28–34. p. 94

Root thick; stems single or few, 40–100 cm high, glabrous or pubescent below, erect or ascending at the base, branched throughout; leaves lanceolate to linear-lanceolate, 2–5 cm long and 2.5–8 mm broad, obscurely trinervate, acuminate; inflorescence paniculate-dichasial, globular, with a large number of flowers; bracts deltoid, acute; pedicel capillary, 2–6 mm long; calyx widely campanulate, 1.5 mm long, lobes ovate, rotundate; petals cuneate, rotundate, white, one and a half to two times as long as the calyx; stamens nearly as long as the petals, spreading; ovary globose; styles long, spreading, stigmatose inside in the upper third; ovules 4–8; capsule globose, slightly longer than the calyx, 4-valved; seeds over 1 mm  $\times$  over 1 mm, with obtuse tubercles. Fl. Jun–Jul.

In steppes, along the edges of pine forests and on sandy and calcareous hills.

a. Var. *paniculata*: Stems glabrous; leaves, bracts and pedicels glabrous.

Type: *Gypsophila paniculata* L. n. 579, 5 in (LINN), the numbers 579 6, 7 and 8 are other authentic specimens.

Geographic distribution: C. and E. Europe (Austria, Czechoslovakia, Hungary, Yugoslavia, Romania, Bulgaria, Central, East and West Great Russia); Asiatic U.S.S.R. (Caucasus, West Siberia, Middle Asia); Mongolia; West China. It is also found in West Europe and North America as an adventive species or a garden escape.

AUSTRIA: Wagram, near Wien, Allioner 34 (JE). U.S.S.R.: GREAT RUSSIA: Lower Volga (Sarepta) near Stalingrad, Becker s.n. 1896 (M, FI). WEST SIBERIA: Ural, Bureau s.n. 1875 (W); along the river Vishera, coll. ? (M). KUBAN: Schiffers 1725 (LE). CAUCASUS: Elisabethpol, Hohenacker s.n. (M). TRANSCAUCASIA: Azerbaijan,

Karjagin, I. s.n. 1927 (LE). KAZAKHSTAN: Uralsk, Burmester s.n. (FI). TURGAY: Krascheninnikov 5177 (W); Semipalatinsk, Kossinsky, G. s.n. 1914 (FI). CHITA TARBAGATAY: Potanin, G. s.n. 1876 (E, W). ASTRAKHAN: Presscott s.n. (E). MIDDLE ASIA: Chaffanjon s.n. 1895 (W). TAURIA "Crimea", Callier, A. s.n. 1896 (FI). IRAN: north-western part, Vezirabad, Knapp s.n. 1884 (JE). CHINA: Sinkiang, Dzungaria, Schrenk s.n. (FI, M).

b. Var. *adenopoda* Borbás ex Hallier-Koch, Syn. 1: 328 (1891).

Lower part of the stem pubescent, lower leaves more or less hairy, pedicel and bracts more or less glandular-hairy.

Type: Hungary: near Budapest, Borbás. Topotype Borbás 3629 (L).

Geographic distribution: Very rare in Central Hungary.

49. *G. bicolor* (Frey et Sint) Grossheim, Monit. Jard. Bot. de Tiflis Ann. 13-14: 60 (1919). Basionym: *Gypsophila paniculata* L. ssp. *bicolor* Frey et Sint, Bull. Herb. Boiss. ser. 2, 3: 864 (1903).

Hetrotypic synonym: *Gypsophila paniculata* L. var. *latifolia* Hohen., Talysch 159 (1838). Type: Hohenacker from Georgia, Transcaucasia s.n. 1834 (M)!; *Gypsophila paniculata* L. var. *effusa* Fenzl in Ledebour, Fl. Ross. 1: 297 (1842). Type: the same as that of the last synonym; *Gypsophila paniculata* L. var. *hirta* Gruner, Bull. Soc. Nat. Mosc. 40, 4: 406 (1867). Type: Gruner from Apzheronskiy peninsula, Caspian Sea (not seen).

Misapplied name: *Gypsophila paniculata* auct. non L.; Boiss., Fl. Or. 1: 542 (1867).

Plate VIII, Fig. 1-6. p. 100

This species is somewhat similar to the preceding. It is characterized by being completely glabrous, having non-glaucous broader leaves (5-17 mm), tinged with yellow, a more or less corymbose inflorescence, longer pedicels (3-10 mm), a larger calyx (1.5-2.5 mm), mostly purplish with cordate rotundate lobes, petals one and a half to two times as long as the calyx, ovoid ovary. Fl. Jul., fr. Aug.

On dry steppe, sandy hills, in open forests, fallow fields and rarely in cultivated fields.

Type: U.S.S.R.: Turkmenia, Ashkhabad, Neftonska, Sint 423. Holotype (W), isotypes (E, L).

Geographic distribution: U.S.S.R. (Kazakhstan: Kyzyl Kum; Turkmenia: Kara Kumy, Kopet Mts.; Caucasus; Transcaucasia: Talysh, Azerbaijan; Turkestan): Iran: (Khurasan, Tehran, Isfahan, Tabriz); Turkey.

TURKMENIA: near Ashkhabad, Litwinow 805 (E); Kyzyl Arvat, Kara Kala, Sint 1859 (BM, JE). TRANSCAUCASIA: Georgia, Hohenacker s.n. 1843 (K, L, M); near Tbilisi, Grossheim 303 (BM, K). AZERBAIJAN: Shirvan steppe near Berdevel and Alchasava, Sachokia, M. s.n. 1931 (K). IRAN: Khurasan, between Shahrud and Nishapur, Bunge s.n. 1858 (FI, K, M, P); Elburz Mts. near Teheran, Karaj, Rechinger 735 (K, W); Prov. Kermanshah, Mt. Burudjir, Strauss s.n. 1895 (JE); Prov. Tabriz, Gilliat-Smith 1721 (K). TURKEY: Wilayet Van, Van, Davis 22631 (O. Polunin) (E, K); Wilayet Antalya, distr. Elmali, Elmali-Avlon Gölü, Khan, Prance and Ratcliffe 167 (E). TURKESTAN: Samarkand, Regel, H. s.n. 1882 (K).

Note: The root of this species contains about 10 % saponin and is used often by the local population instead of soap.

50. *G. arrostii* Gusson, Pl. Rar. Sic. 160 (1826); Fl. Sic. 160 (1829); Halácsy, Consp. Fl. Graec. 1: 192 (1900). Based on: *Arrostia dichotoma* Raf., Car. genus 53 (1810). Type: Rafinesque-Schmaltz from the mountains of Sicily (B destroyed).

Homotypic synonym: *Gypsophila dichotoma* (Raf.) Gusson, Ind. Sem. Hort. Roy. Bocc. Ann. (1825), non Besser.

Heterotypic synonym: *Gypsophila arrostii* Guss. var. *glaberrima* Ströbl., Oester. Bot. Zeit. 35: 280 (1895). Type: Ströbly s.n. from Sicily, between Bronte and Maletto (FI)!

Misapplied name: *Gypsophila altissima* auct non L.; Sibth. et Smith, Fl. Graec. Prod. 1: 280 (1806).

Plate VIII, Fig. 7–11.

Stems 30–60 cm high, glabrous or glandular-pubescent, branched throughout; internodes 4–5 cm long, lower branches mostly sterile, the upper ones fertile, filiform; leaves linear-lanceolate to linear, 1–5 cm long, 1–5 mm broad, the broad ones obscurely trinervate, acuminate, narrowed at base, glabrous; inflorescence lax, paniculate-dichasial; bracts very small, linear, obtuse, expanded at base, leafy; pedicel to 2.5 cm long, mostly 1 cm long, capillary, often recurved; calyx wide-campanulate, 2–2.5 mm long, not persistent around the fruit, with oblong, rotundate lobes, calcium-oxalate crystals in the parenchyma few; petals linear, the claw mostly broader than the limb, about one and a half times as long as the calyx, with rotundate apex and narrowed base; stamens nearly as long as the petals; ovary ovoid, with long divergent styles; ovules 12; capsule dehiscent irregularly, sometimes four-valved; seeds 1.5 mm × 1.5 mm, with obtuse tubercles. Fl. June, fr. July.

On stony arid calcareous soil, to 700 m alt.

a. var. *arrostii*: Stem glabrous or with scattered glandular hairs; leaves, bracts, and pedicel glabrous.

Type: Italy: Sicily, Gussone s.n. (FI).

Geographic distribution: Sicily, South Italy, rare in N. Italy; one old collection from Greece.

SICILY: Messina, near Bordonaro, Mangano 2661 (FI, K). S. ITALY: Calabria, near Grottalia di Gerate and near Muraro, Huter, Porta and Rigo s.n. 1877 (M), and n. 412 (FI, K, M). GREECE: Sibthorp s.n. (OXF).

b. var. *pubescens* Gusson, Fl. Sic. Syn. 1: 471 (1824); Pl. Rar. Sic. 160 (1826).

Homotypic synonym: *Gypsophila pubescens* (Guss.) G. Don, Gen. Syst. 1: 383 (1831).

Stem, leaves, inflorescence, and pedicel more or less glandular-hairy, pubescent; otherwise as the type variety.

Type: Sicily, Taormina, Ross 614 (L).

Geographic distribution: very rare in Sicily.

c. var. *nebulosa* (Boiss. et Heldr.) Barkoudah stat. nov.

Basionym: *Gypsophila nebulosa* Boiss. et Heldr. in Boiss., Diagn. ser. 1 (viii): 58 (1849).

Inflorescence denser than in the type var.; pedicel not exceeding 1.5 cm; leaves smaller, more lanceolate than linear; capsule dehiscing mostly by four valves.

Type: Turkey: Wilayet Antalya, near Beyshahr, Heldreich s.n. 1846. Holotype (not seen), isotypes (K, P).

Geographic distribution: Endemic to Central Turkey.

TURKEY: Wilayet Antalya, near Karaman, Heldreich 948 (FI, M); Elmali, Elmali-Avlon Gölü, Khan, Prance and Ratcliffe 167 (K); *ibid.*, Bourgeau 40 (K, L, M); Wilayet Ankara, Kotte 128 bis (K).

This species can easily be distinguished from *Gypsophila paniculata* L. and *G. bicolor* (Freyen et Sint) Grossheim by having smaller leaves, a longer pedicel, entire calyx lobes, petals with broad claw, and capsule which mostly does not dehisce by valves.

51. *G. simulatrix* Bornmüller et Woronow, Mon. du Jard. Bot. de Tiflis 29: 28 (1913); Grossheim, Fl. Cauc. 2: 423 (1936).

Plate VIII, Fig. 17–24. p. 100

Stems erect, whitish-glaucous, glabrous, viscous on the upper internodes by sessile glands, 50–70 cm high, branched in the upper part, internodes 3–9 cm long; leaves spatulate to linear-lanceolate, 2–4.5 cm long and 2–12 mm broad, glaucous, with 1 to 3 nerves, acute to obtuse, narrowed at base; inflorescence a rather dense panicle of dichasia, pedicel up to 4 mm long, mostly 3 mm long; bracts ovate, acuminate; calyx small, wide-campanulate, 2–2.5 mm long, with semi-circular, ciliate lobes, a very large number of calcium-oxalate crystals in the parenchyma; petals linear-cuneate, about one third longer than the calyx, rotundate, white; stamens shorter than the petals; ovary globose, with short divergent styles; ovules 4–8; capsule obovoid, as long as the calyx; seeds 1.3 mm  $\times$  1.3 mm, with acute tubercles. Fl. Jun., fr. Jul.

In crevices of calcareous rocks and on rocky slopes.

Type: Turkey: Wilayet Çoruh (Artvin): near Lamaşen, Woronow 269. Holotype (TB not seen), isotype (LE).

Geographic distribution: Transcaucasia and E. Turkey.

TRANSCAUCASIA: Woronow 6319 (LE). TURKEY: Wilayet Çoruh (Artvin): Artvin-Ardanuç, Davis & Hedge D. 30071 (E, K); *ibid.*, near Ardanuç, Turkewicz 613 (K).

52. *G. krascheninnikovii* Šiškin, Trav. du Musée Bot. de l'Acad. Sc. de l'U.S.S.R. 24: 36 (1932); Komar., Fl. U.S.S.R. 6: 751 (1936).

Plate VIII, Fig. 12–16. p. 100

Stem erect, branched in the upper part, glabrous, 60–100 cm high; leaves oblong-spatulate or oblanceolate, 3.5–6 cm long and 8–16 mm broad, glaucous, acute to obtuse, obscurely trinervate; inflorescence a rather dense panicle of dichasia, glandular-pubescent; pedicel capillary, 5–8 mm long, glabrous or glandular-hairy at base; bracts ovate, acuminate, ciliate; calyx wide-campanulate, about 2 mm long, with oblong, rotundate, ciliate lobes; petals cuneate, about one and a half

times as long as the calyx; ovary globose, with long incurved styles; ovules 4–6; capsule globose, as long as the calyx, seeds 1 mm  $\times$  1 mm, with acute tubercles. Fl. Jun., fr. Jul.

On sandy and solonyets steppe, on sandy banks of rivers and on stony hills.

Type: Turkestan: Prov. Uralsk: distr. Temir, Kasha, Borodin, Uvarov and Sits (LE not seen). Paratype: Between the river Uil and Emba in the Sağyz valley, Krascheninnikov 177 (K).

Geographic distribution: U.S.S.R.: Turkestan: Ural-Caspian region.

53. *G. belorossica* Barkoudah sp. nov.

Plate VIII, Fig. 33–41. p. 100

Perennis, radice perpendiculari ca. 1 cm crassa; caulibus numerosis, 20–40 cm altis et 3 mm crassis, erectis, dimidio superiore ramosis, fere omnino glanduloso-pubescentibus, pubescentia dimidio superiore densiore; internodiis ca. 5 cm longis; foliis linearibus acutis, ad basim angustatis et connatis, ca. 5 mm longis et 3–5 mm latis, caulibus minutis et angustatis; inflorescentia laxa, trichotomo-dichasiali, bis composita, glanduloso-pubescente; bracteis ovatis acuminatis, facie dorsali glanduloso-pubescentibus; pedicellis capillaribus, glabris, ca. 5 mm longis; calycibus late campanulatis, 2.5 mm longis et 2.5 mm latis, ad medium partitis, laciniis ovatis obtusis, minute ciliatis; petalis albis, oblongis, rotundis vel retusis, ad basim angustatis, calycem medio superantibus, ca. 1 mm latis; staminibus petalis longioribus; ovario obovoideo; stylis divergentibus, ovulis 16–18; capsula globosa, calyce longiore, quadrivalvi; seminibus gibbosis, radícula saliente.

Type: White Russia: Minsk region: Orsha distr., between Lyady and Molde Magdkos, Savicz 33 (LE).

Geographic distribution: Only known from the type collection.

This species differs from *Gypsophila fastigiata* L. by its broader leaves, much looser inflorescence, acute calyx lobes, broadly clawed petals, fewer ovules and obtusely tuberculate seeds.

Subsection B. *Acutifoliae* (Šiškin) Barkoudah comb. nov. p. 41

54. *G. acutifolia* Fischer ex Spreng., Novi Prov. Hort. Acad. Halens. et Berol. 21 (1818); DC., Prod. 1: 353 (1824); Boiss., Fl. Or. 1: 540 (1867) p. part.; Rchb. Ic. Fl. Germ. 6: t. 242, fig. 5004 (1844).

Homotypic synonym: *Gypsophila acutifolia* Fisch. var. *latifolia* Fenzl in Ledeb., Fl. Ross. 1: 295 (1841).

Misapplied name: *Gypsophila altissima* auct. non L.; Bieb., Fl. Taur. Cauc. 1: 319 (1819).

Plate VIII, Fig. 25–32. p. 100

Stems erect, 25 cm — more than 1 m high, glabrous below, branched and glandular-pubescent in the upper half; leaves linear-lanceolate, long-acuminate, narrowed at the base, obscurely trinervate, 2–8 cm long, 2–8 mm broad; inflorescence lax, dichasial, corymbose-paniculate, glandular-hairy; bracts lanceolate, long-acuminate, mostly

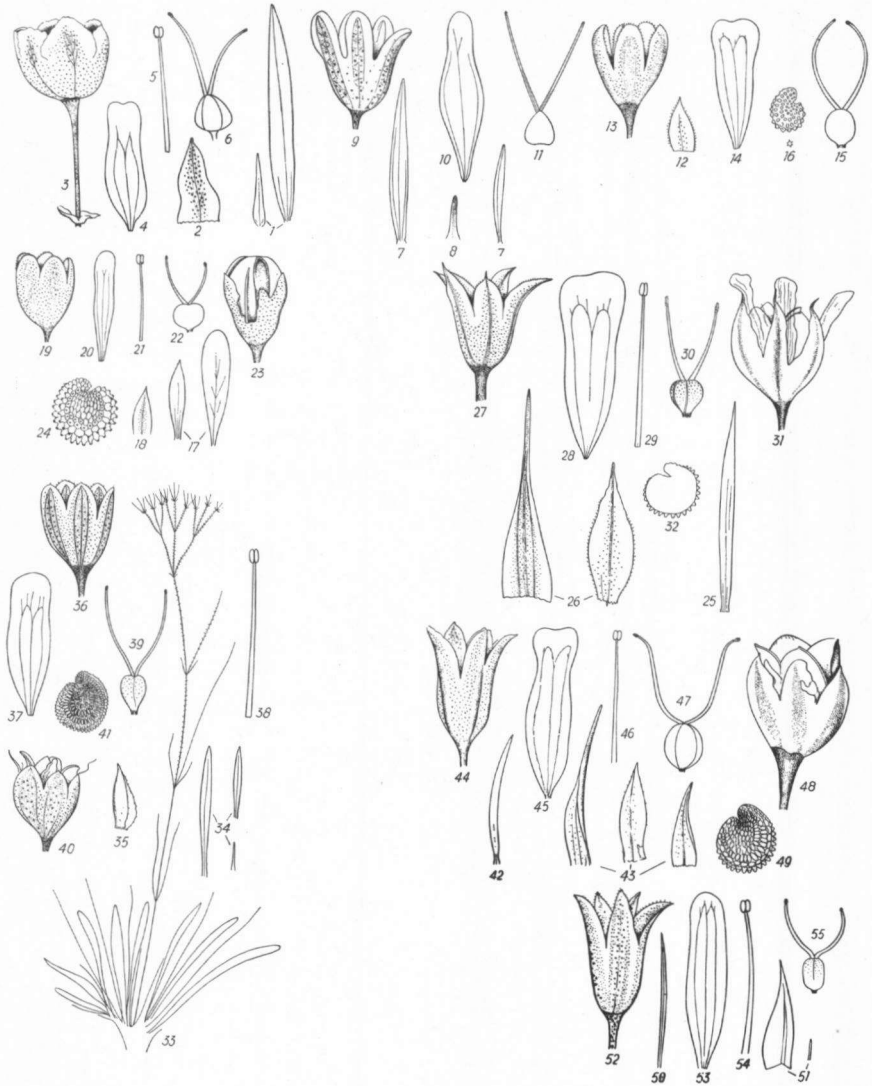


Plate VIII. Fig. 1-6: *G. bicolor*; 1: leaves; 2: bract; 3: calyx; 4: petal; 5: stamen; 6: ovary. Fig. 7-11: *G. arrostii* var. *arrostii*; 7: leaves; 8: bract; 9: calyx; 10: petal; 11: ovary. Fig. 12-16: *G. krascheninnikovii*; 12: bract; 13: calyx; 14: petal; 15: ovary; 16: seed and tubercle. Fig. 17-24: *G. simulatrix*; 17: leaves; 18: bract; 19: calyx; 20: petal; 21: stamen; 22: ovary; 23: capsule; 24: seed. Fig. 25-32: *G. acutifolia*; 25: leaf; 26: bracts; 27: calyx; 28: petal; 29: stamen; 30: ovary; 31: capsule; 32: seed. Fig. 33-41: *G. belrossica*; 33: caudex with one stem; 34: leaves; 35: bract; 36: calyx; 37: petal; 38: stamen; 39: ovary; 40: capsule; 41: seed. Fig. 42-49: *G. stevenii*; 42: leaf; 43: bracts; 44: calyx; 45: petal; 46: stamen; 47: ovary; 48: capsule; 49: seed. Fig. 50-55: *G. meyeri*; 50: leaf; 51: bracts; 52: calyx; 53: petal; 54: stamen; 55: ovary



ciliate; pedicel as long as the calyx or longer, to 4 mm, glandular-hairy at the base; calyx campanulate, 3–3.5 mm long, with ovate, acuminate or apiculate lobes; petals oblong-cuneate, one and a half to two times as long as the calyx; truncate to shallowly emarginate, angustate at base, white; stamens shorter than the petals; ovary obovoid with short, divergent styles; ovules 12–16 (24); capsule as long as the calyx, seeds 1.2 mm  $\times$  1.2 mm, with acute tubercles on the back. Fl. Jun., fr. Jul.

On dry stony hills.

Type: Neotype: Georgia, Willdenow (B-Willd.). The original type was destroyed in Berlin.

Geographic distribution: U.S.S.R. (Transcaucasia: Georgia, Dagestan, Armenia). According to ŠIŠKIN (1936) this species is adventive in the Black Sea region, in the Crimea, and here and there in Western Europe.

GEORGIA: Tbilisi, Hohenacker 1842 (FI, K, L, P); *ibid.*, Sommier and Levier 163 (FI); *ibid.*, Grossheim s.n. 1919 (L, W); Marienfeld near Tbilisi, Hohenacker s.n. 1833 (BR, FI); Elisabethpol, Hohenacker s.n. 1844 (B. Willd.). DAGESTAN: distr. Temir-Shan-chura, near St. Kizil-jar, Alexeenko 4128 (LE); Dagestan, Backer 74 (K). ARMENIA: Szovits 130 (P).

55. *G. stevenii* Fischer ex Schrenk, Pl. rar. Hort. Monac. 32, t. 32 (1819); Link, Enum. Hort. Berol. 1: 417 (1821); DC., Prod. 1: 353 (1824); Šiškin in Komar., Fl. U.S.S.R. 6: 758 (1936).

Homotypic synonym: *Gypsophila acutifolia* Fischer var. *angustifolia* Fenzl in Ledeb., Fl. Ross. 1: 295 (1842). Heterotypic synonym: *G. glauca* Stev. ex Ser. in DC., Prod. 1: 353 (1824). Type: Bieberstein from the Caucasus (LE not seen). Misapplied name: *G. repens* auct. non L.; Bieb., Fl. Taur. Cauc. 1: 318 (1808).

Plate VIII, Fig. 42–49. p. 100

Root thick, 5–15 mm; stems few, ascending at the base, branched nearly throughout, glabrous below, glandular-hairy in the inflorescence, 10–60 cm high; leaves linear, 1–4 cm long, 1–3 mm broad, acute, mostly falcate; inflorescence lax, glandular-hairy; bracts ovate, acuminate, mostly ciliate; pedicel 2–10 mm long, glabrous or with some glandular hairs; calyx campanulate, 3–4 mm long, with ovate, acuminate lobes, mostly ciliate; petals oblong, with a shallow contraction between the limb and the claw, retuse to shallowly emarginate, white; stamens shorter than the petals; ovary globose, with short divergent styles; ovules 16; capsule slightly exceeding the calyx; seeds 1.2 mm  $\times$  1.2 mm, with obtuse tubercles. Fl. Jun., fr. Jul.

On rocky slopes and in steppes.

Type: Schrenk, Pl. Rar. Hort. Monac. (1819) t. 32. The original type was destroyed in Berlin during the last war.

Geographic distribution: Caucasus region: Georgia, Azerbaijan.

GEORGIA: Tbilisi, near Dabahane gorge, Davis 33721 (E, K); *ibid.*, Schumann s.n. 1881 (JE); *ibid.*, A. Rehmann s.n. (P); Mt. Kazbek, Fischer (K); Elisabethal, Hohenacker s.n. (1834) (K); Tbilisi, near Tzavkisi, Grossheim 256 (BM, K). AZERBAIJAN: Chadarin 932 (K); Kuban, Busch 750 (LE).

This species differs from the related *Gypsophila acutifolia* Fisch. by having a lower stem, branched throughout, much smaller not long-acuminate, cauline leaves, longer pedicel and obtusely tuberculate seeds.

56. *G. meyeri* Ruprecht, Fl. Cauc. 178 (1869); Boiss., Fl. Or. Suppl. 85 (1888); Komar., Fl. U.S.S.R. 6: 759 (1936).

Misapplied name: *Gypsophila steveni* auct. non Fischer; C. A. Meyer, Verzeichn. Pfl. Cauc. 210 (1831).

Plate VIII, Fig. 50-55. p. 100

Stem 20-50 cm high, branched throughout, glabrous below, glandular-hairy in the upper part; leaves linear to linear-subulate, 3-15 cm long and 1-2 mm broad, acute, the cauline ones much smaller; inflorescence lax, glandular-hairy; bracts lanceolate, acuminate, glandular-ciliate; pedicel to 12 mm long, mostly longer than the calyx; calyx campanulate, 3-3.5 mm long, with triangular acuminate lobes, ciliate; petals linear-oblong, one and a half times as long as the calyx, with rotundate apex and narrowed base; stamens shorter than the petals; ovary obovoid with short divergent styles and about 12 ovules. Fl. Jun.-Jul.

On calcareous rocks and stony hills.

Type: Caucasus: Kuban river, C. A. Meyer s.n. (LE).

Geographic distribution: Caucasus: Kuban river region.

CAUCASUS: Fisher s.n. in herb. Schreber (P); E. Russia, without exact loc., Prescott s.n. (FI).

This species differs from the two last species, *G. acutifolia* Fisch. and *G. stevenii* Fisch., by its narrow leaves, long pedicel, rotundate petals, and fewer ovules. Unfortunately, the available material of these three species was scanty and not very well preserved. It is not impossible that a thorough study of these three species would show them to be only subspecies of one more widely construed species.

57. *G. albida* Šiškin, Candollea 3: 474 (1928); Komar., Fl. U.S.S.R. 6: 753 (1936).

Plate IX, Fig. 1-8. p. 106

Stems few, slender, glaucous, branched throughout, glabrous below, glandular-hairy in the upper part, 15-30 cm high; leaves lanceolate, 2-3 cm long and 2-10 mm broad, acute, glaucous; inflorescence lax, glandular-hairy; bracts triangular, acuminate, glandular-hairy on the lower side; pedicel up to 5 mm long, usually as long as the calyx, glandular-hairy; calyx campanulate, 3-3.5 mm long and as wide, more or less glandular-hairy, with oblong, acuminate, ciliate lobes; petals oblong-cuneate, one and a half times as long as the calyx, truncate to shallowly emarginate, narrowed at base; stamens shorter than the petals; ovary globose to obovoid, with short divergent styles; ovules about 16; capsule as long as the calyx; seeds 1.3 mm × 1.3 mm, with flat tubercles. Fl. Jul., fr., Aug.

On steppes.

Type: Transcaucasia: Nakhichevan: near Kulim, Lipsky s.n. 2 (VIII) 1893. Holotype (LE).

58. *G. scariosa* Tausch, Flora 14 (I): 213 (1831).

Plate IX, Fig. 9-14. p. 106

Stems slender, erect, 30-40 cm high, glaucous, branched in the upper part, glabrous below, glandular-pubescent on the upper internodes, internodes 3-5 cm long; leaves linear-lanceolate, 8-11 cm long, 3-5 mm broad, long-acuminate, narrowed at base, the cauline ones longer than the internodes, glaucous; inflorescence dense, glandular-pubescent; bracts lanceolate, long-acuminate, ciliate, pedicel to 3 mm long, shorter than the calyx, glabrous; calyx campanulate, 4-5 mm long, with lanceolate, acuminate, ciliate lobes; petals oblong-cuneate, as long as the calyx, shallow emarginate, narrowed at base, spreading, with a shallow contraction between the limb and the claw; stamens as long as the petals, with thick filaments; ovary globose, with long divergent styles; ovules about 20; capsule and seeds unknown.

Type: Cultivated in Hort. Prag. (PR).

Geographic distribution: Only known from the Mts. between Italy and Switzerland.

SWITZERLAND: near the Italian border, Mt. Septim, Thomas de Bex s.n. 1844 (P). Mt. Gadro, Thomas s.n. 1866 (K).

Note: It would be worthwhile to investigate whether this species still occurs in a natural state. As far as I know it has not been recorded since the last collections were made.

Subsection C. *Trichotomae* Williams p. 41

59. *G. perfoliata* L., Sp. Pl. 408 (1753) p. part. in Orient; DC., Prod. 1: 352 (1824); Ledeb., Fl. Ross. 1: 297 (1842); Bieb., Fl. Taur. Cauc. 1: 320 (1808).

Heterotypic synonyms: *Gypsophila trichotoma* Wenderoth, Linnaea 11: 92 (1837); Boiss., Fl. Or. 1: 541 (1867); Komarov, Fl. U.S.S.R. 6: 759 (1936); Kuč, M., Frag. Fl. et Geog. of Bot. Acad. Polon. Ann. 3 pars 2: 29-33 (1958). Type: Cult. in Hort. Marburg from seeds collected in Turkestan (destroyed); *Gypsophila perfoliata* L. var. *pubescens* Fenzl in Ledeb., Fl. Ross. 1: 297 (1842). Type: Kazakhstan, Semipalatinsk, Karelin and Kirilof 630 is an authentic specimen (BM, P); *Gypsophila perfoliata* L. var. *tomentosa* Ser. in DC., Prod. 1: 352 (1824); Ledebour, Icon. Pl. Fl. Ross. 2: t. 176 (1830). Type: Tauria (Crimea), Beaupré (not seen).

Plate IX, Fig. 15-22. p. 106

Stems ascending at the base, glandular-pubescent in the lower half, much branched and glabrous in the upper half, 25-100 cm high; leaves ovate to oblong, the upper ones gradually linear-oblong, 2-8 cm long and 1-3.5 cm broad, acute to obtuse, glandular-puberulent to glabrous, with three or more nerves; inflorescence lax, spreading, globose in circumference; bracts triangular, acuminate, glabrous; pedicel to 15 mm long, always longer than the calyx, glabrous; calyx campanulate, 2-2.5 mm long, with ovate, obtuse lobes; petals oblong, white, pink or red, one and a half to two times as long as the calyx,

truncate, with a shallow contraction between the limb and the claw, narrowed at the base; stamens shorter than the petals, spreading; ovary ovoid with long, incurved styles; ovules 12–16; capsule slightly longer than the calyx, with 4–8 seeds; seeds 1 mm  $\times$  0.8 mm, with small flat tubercles. Fl July–Aug., fr. Aug.–Sept.

On solonchets and sandy meadows and on fallow fields.

a. var. *perfoliata*: Stems 50–100 cm high; leaves mostly ovate; petals pink to red, one and a half times as long as the calyx.

Type: *Gypsophila perfoliata* L. n. 579 16 (LINN).

Geographic distribution: U.S.S.R. (Black Sea region: Crimea, Lower Don, Lower Volga, Transvolga; Caucasus; West Siberia: Upper Tobol, Irtysh, Altai; Middle Asia: Aralo-Caspian region, Balkash region); Romania; Bulgaria; E. Turkey; N. Iran, Mongolia; China.

ROMANIA: Letea Island, Cretzoiu s.n. 1936 (K). UKRAINE: Dniepropetrovsk, Greke, A. s.n. (B). CRIMEA: Yalta, Reusch s.n. (B); Yevpatoriya, Callier, A. s.n. 1900 (B, JE, M). CAUCASUS: Bunge s.n. (P). LOWER VOLGA: Krasnoarmeysk (Sarepta), Becker 125 (BR, FI, JE, K, P). TURKMENIA: Ashkhabad, Sint 629 (L, LE). ALTAI: Bunge s.n. (P); *ibid.*, Ledebour s.n. (W). CENTRAL ASIA: without exact locality, Chaffanjon s.n. 1895 (P). DZUNGARIA: Schrenk s.n. (P). TIEN SHAN: Suidum, Regel s.n. 1877 (P). MONGOLIA: Northern part, lake Ubsa, Potanin s.n. 1879 (E, FI). TURKEY: Wilayet Erzincan, east of Erzincan, Davis and Hedge D. 31842 (E, K); Besh geuz, Kara Dag, Balls 2038 (E); Wilayet Kanye, Cihanbeyli distr., Boluk Gölü, Khan, Prance and Ratcliffe 435 (E, K). IRAN: Pallas s.n. (B-Willd.).

b. var. *anatolica* (Boiss. et Heldr.) Barkoudah stat. nov.

Basionym: *Gypsophila anatolica* Boiss. et Heldr. in Boiss., *Diagn. ser. 1*, (viii): 57 (1849); *Fl. Or.* 1: 542 (1867); Parsa, *Fl. de l'Iran 1*, 2: 1023 (1951).

Homotypic synonym: *Gypsophila trichotoma* Wend. var. *anatolica* (Boiss. et Heldr.) Bornmüller, *Verh. Zool. Bot. Gesel. Wien* 60: 81 (1910).

Heterotypic synonyms: *Gypsophila hygrophila* Post, *Fl. Syr. Pal.* 5 (1895); ed. 2, 1: 165 (1932). Type: Syria, Al Karyatayn, Mar Lian, Post s.n. 1890 (K); *Gypsophila anatolica* Boiss. et Heldr. var. *bertonii* Gomboult, *Bull. Soc. Bot. Fr.* t. 93, p. 147 (1946). Type: Syria, south-east of Damascus, Kharata, Berton s.n. 1927 (P).

Stems 25–60 cm high; leaves mostly oblong; flowers with longer petals, these sometimes more than twice as long as the calyx.

Type: Turkey: Cappadocia, along the Euphrates, Aucher-Eloy 545. Holotype (G-Boiss. not seen), isotypes (FI, P).

Geographic distribution: Caucasus, Transcaucasia, Armenia, Middle and East Turkey, East Syria, West Iran, Iraq.

TRANSCAUCASIA: around Tbilisi, W. Schumann s.n. 1881 (JE). ARMENIA: Szovits 617 (K, L, P); prov. Yerevan: Etshmiadzin, near Ajgergöl, Grossheim 83 (K, LE). TURKEY: near Kayseri, Bornmüller 1785 (K, P); Wilayet Konya: Kashanan, Davis 14756 (K); Wilayet Erzincan: Besh Buez "Kara Dag", Balls and Gourlay B. 2038 (K). SYRIA: Al Hijanah, Eig and Zohary 13521, 13522, 13523 and 13524 (HUJ). IRAQ: Jabal Sinjar, Handel-Mazzetti 1636 (not seen). IRAN: N.W.: Azerbaijan: Takht-Sulaiman (Afshar), Bornmüller 1909 (not seen).

Note: BLACKLOCK (1957) retained the name *Gypsophila anatolica* Boiss. et Heldr., following Šiškin *Fl. U.S.S.R.* 6: 761 (1936). He misinterpreted Šiškin's

description of the pedicel "capillary" as "hairy" which would imply a much greater difference between the two taxa than there actually is.

60. *G. scorzonrifolia* Seringe in DC., Prod. 1: 352 (1824); Spreng., Syst. Veget. 2: 329 (1825); Šiškin in Komar., Fl. U.S.S.R. 6: 760 (1936).

Homotypic synonym: *Gypsophila perfoliata* L. var. *angustifolia* Fenzl in Ledeb., Fl. Ross. 1: 296 (1842).

Heterotypic synonym: *Gypsophila trichotoma* var. *glabra* Fenzl in Ledeb., l. c. 297 (1842). Type (not cited).

Plate IX, Fig. 23–31. p. 106

Very similar to the preceding species but glaucous, glabrous in the lower part, glandular-hairy in the inflorescence; pedicel glandular-hairy; flowers white or light pink, seeds over 1 mm × 1 mm, with obtuse tubercles.

In wet sandy places.

Type: Caucasus: Dagestan, Kizlyar, Seringe s.n. (P-DC). Isotype? (Holotype said by Šiškin to be in Geneva).

Geographic distribution: around the Caspian Sea.

TURKMENIA: Krasnovodski Peninsula, Sint 1121 (WAG). Reported by Šiškin (1936) from the lower Volga region.

This species has some characters in common with *G. acutifolia*, but is in all its parts more robust.

61. *G. tomentosa* L., Cent. Pl. 1: 11 (1755).

Homotypic synonym: *Gypsophila perfoliata* L. p.p. (quoad specimen *hispanica*); *G. perfoliata* L. var. *tomentosa* (L.) Willk., Prod. Fl. Hisp. 3: 673 (1880) non Ser.

Plate IX, Fig. 32–39. p. 106

Very similar to *Gypsophila perfoliata* L. (under which it is sometimes described as a var.), but the whole plant glandular-pubescent; pedicel capillary, glabrous, 6–15 mm long; bracts triangular, obtuse; calyx lobes ovate, obtuse; petals with rotundate apex; seeds 1 mm × 1 mm, smooth, not tuberculate, black, shining. Fl. Jul., fr. Aug.

On soil rich in gypsum, mostly in wet places.

Type: *Gypsophila tomentosa* L. n. 579 17 (LINN).

Geographic distribution: Central and North-East Spain.

Ciempozuelos near Madrid, Bourgeau 2254 (FI, K, P); Vale Moro near Madrid, Ysern (FI); near Madrid, Reuter s.n. 1841 (FI, K); Aranjuez, New Castilia, Ysern s.n. (JE); Catalonia: Prov. Lérida, Prado de Mousoa near Ivars, Sennen 1220 (L, U).

62. *G. × castellana* Pau (*G. tomentosa* × *G. hispanica*), Boletín de la Sociedad Aragonesa de ciencias naturales. 15: 167 (1916).

Plate IX, Fig. 40–45. p. 106

Plant everywhere glandular-pubescent; stem 30–50 cm high, branched; leaves linear, fleshy, obtuse, about 2 cm long and 1–2 mm broad; inflorescence paniculate, lax; bracts lanceolate, acuminate, glandular-hairy; pedicel to 5 mm long, glabrous; calyx campanulate,



Plate IX. Fig. 1-8: *G. albida*; 1: leaf; 2: bract; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed. Fig. 9-14: *G. scariosa*; 9: leaf; 10: bracts; 11: calyx; 12: petal; 13: stamen; 14: ovary. Fig. 15-22: *G. perforliata* var. *perforliata*; 15: leaves; 16: bracts; 17: calyx; 18: petal; 19: stamen; 20: ovary; 21: capsule; 22: seed and its tubercle. Fig. 23-31: *G. scorzonerifolia*; 23: leaf; 24: bracts; 25: calyx; 26: petal; 27: stamen; 28: ovary; 29: placenta; 30: capsule; 31: seed. Fig. 32-39: *G. tomentosa*; 32: leaf; 33: bract; 34: calyx; 35: petal; 36: ovary; 37: capsule; 38: seeds; 39: embryo. Fig. 40-45: *G. X castellana*; 40: bract; 41: calyx; 42: petal; 43: stamen; 44: ovary; 45: opened ovary. Fig. 46-52: *G. robusta*; 46: leaves; 47: bracts; 48: calyx; 49: petal; 50: stamen; 51: ovary; 52: seed. Fig. 53-58: *G. oblanceolata*; 53: leaves; 54: bract; 55: calyx; 56: petal; 57: stamens with nectary pockets at their base; 58: ovary

2.5 × 3 mm long, with ovate obtuse lobes; petals cuneate, about one and a half times as long as the calyx, with rotundate apex and angustate base; ovary ovoid, with long erect styles; ovules about 20. Fl. Aug.

Type: Ciempozuelos, New Castilia, Madrid region, C. Pau s.n. 11 Aug. 1897. Holotype (MA not seen), isotype (JE).

New Castilia: Valdimoro, Beltrán 1341 (JE); Ciempozuelos, S. Rivas Goday s.n. 1947 (U).

63. *G. robusta* Grossheim, Bull. Hort. Bot. Tifl. fasc. 51: 30 (1920), Grossh., Fl. Cauc. 2: 422 (1936); Šiškin in Komar., Fl. U.S.S.R. 6: 761 (1936).

Heterotypic synonym: *Gypsophila yorae* Woron., Not. Syst. ex Herb. Hort. Bot. Petr. 5: 62 (1924); Grossh., Fl. Cauc. 2: 422 (1936); Komar., Fl. U.S.S.R. 6: 761 (1936); Charadze, Not. Syst. Georg. Inst. Bot. Tifl. fasc. 11 (10): 14–18 (1940). Type: Caucasus: Along the river Iora, near Sarticala, Woronow s.n. 20 (VIII) 1918 (LE)!

Plate IX, Fig. 46–52. p. 106

Root thick, 5–6 cm in diam., to 100 cm long; stems usually many, 40–100 cm high, glaucous, glandular-hairy in the lower part, glabrous above; basal leaves elliptic-lanceolate to ovate-lanceolate, acute, narrowed at base, 10–13 cm long and 2.5–5 cm broad, with 5–9 nerves, glandular-pubescent; cauline leaves lanceolate to broadly lanceolate, 5–9 cm long and 8–20 mm broad, the upper ones mostly glabrous or only with hairs on the edge; inflorescence spreading, loosely paniculate; bracts triangular, acuminate, mostly ciliate; pedicel 3–4 times as long as the calyx, glandular-hairy or glabrous; calyx campanulate, 2.5–3 mm long, glandular-hairy or glabrous, with ovate, acute lobes; petals oblong, one and a half time as long as the calyx shallowly emarginate, angustate at the base, light pink to white; stamens shorter than the petals; ovary ovoid, with short divergent styles; ovules 16–20; capsule as long as the calyx; seeds 1 mm × 1 mm, with flat tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

On river banks.

Geographic distribution: Transcaucasia (Azerbaijan, Georgia, Checheno-Ingush), Astrakhan, Caucasus.

Type: Georgia: St. Vasiani, near Tbilisi, Grossheim s.n. 6 (VII) 1920 (TB)?, photo (U). (One flower of the type specimen was kindly sent to me from the Tbilisi Herb.).

GEORGIA: Tbilisi, Sommier and Levier 163 (FI); *ibid.*, Schumann s.n. 1882 (JE, P); along the R. Iora, near Sarticala, near Adzny, Rehmann 93 (P). AZERBAIJAN: Prov. Gandzha, distr. Agdam, Karabakh steppe between Dzinly and Bardy, Prilipko s.n. 1928 (M); Shirvan steppe, Chakhlikh, Udzhary, A. Kolakovsky s.n. 1930 (LE). ASTRAKHAN: Ledebour s.n. (M); *ibid.*, Prescott s.n. (E). CAUCASUS: Bunge s.n. (P).

This species inhabits flooded sandy and alluvial banks. It is geographically isolated from the other species of the Subsect. *Trichotomae*. The species that is geographically and morphologically closest to *G. robusta* is *G. perfoliata* whose area approaches that of *G. robusta* in the North and South; the two species have however ecologically different habitats. This was already noted by CHARADZE

(1940) who came to the conclusion that *G. robusta* was derived from *G. perfoliata* in an interglacial period of the late Pleistocene.

64. *G. oblanceolata* Barkoudah sp. nov.

Plate IX, Fig. 53–58. p. 106

Perennis, suffruticosa, glauco-viridis; caulibus 40–50 cm altis et 5 mm crassis, ad basim glabris, superne glanduloso-pubescentibus, omnino dichotomo-ramosis, internodiis 5–7 cm longis; foliis ad basim caulis approximatis, oblanceolatis, obtusis vel acutis, ad basim angustatis, canescentibus, 5–9 cm longis et 1–2 cm latis, subcarnosis, caulinis minutis, acutis; inflorescentia trichotomo-dichasialis, ter ad quater composita, laxa; bracteis linearibus vel ovatis, acuminatis, ciliatis, facie dorsali glanduloso-pubescentibus; pedicellis 5–25 mm longis, glanduloso-pubescentibus; calycibus late campanulatis, glanduloso-pubescentibus, ad medium partitis, laciniis ovatis, acuminatis, margine anguste scariosis, sepalis tri- vel multinerviis; petalis roseis, patentibus, calyce longioribus, oblongis, ad medium contractis, apice leviter emarginatis, ad basim angustatis; staminibus calyce aequilongis, inaequalibus, episepalis longioribus, ad basim breviter (ca. 1 mm) connatis, tubo intra sub apice excavationibus nectariferis interstaminalibus decem; ovario obovoideo, stylis brevibus, divergentibus, ovulis 12.

In salt marshes.

Type: Turkey: Wilayet Nigde: 2 km E. of Sultanhani between Aksaray and Konya, S. of Tuz Gölü, Davis and Hedge D. 32816, 31 (VIII) 1957. Holotype (E), isotype (K).

This species is closest to *G. perfoliata* L. which also occurs in Turkey. It differs by its oblanceolate leaves, denser inflorescence, glandular-hairy pedicel and calyx, acuminate calyx lobes, the presence of nectary pockets on the inner side of the stamen bases, and obovoid ovary with short styles. Another important difference is in the habitat, i.e. salt marshes. *G. perfoliata* grows in moist places on solonchets steppe or on sandy soil (preferring always moist places).

Subsection D. Suffruticosae Boissier p. 42

65. *G. nabelekii* Šiškin, Candollea 3: 475 (1928); based on: *Gypsophila lignosa* Nábelek, Publ. Fac. Sc. Univ. Masaryk Brno No. 35: 42 (1923), non Hemsl. et Lace, Jour. Linn. Soc. 28: 322 (1891).

Plate X, Fig. 1–9. p. 113

A low shrub; stock woody, branched, (ca. 1 cm diam.); stems numerous (5–20), erect, 7–20 cm high, mostly glandular-pubescent in the lower part, glabrous or with papillose epidermis above; stems of the last year standing as dry erect thin stalks; leaves linear, 1–2 cm long and 1–2 mm broad, acute, fleshy, the basal ones many, subimbricate, mostly glandular-pubescent or papillose, the cauline ones smaller, few, 3–5 pairs; inflorescence dichasial, with 3–9 flowers; bracts triangular, acuminate, scariosus; pedicel shorter than the calyx, to 3 mm long; calyx broadly campanulate, 3–3.5 mm long, with ovate, acute lobes; petals mauve, oblong, about one and a half times as long as the calyx, emarginate to shallowly bilobed, narrowed at the base;



stamens shorter than the petals; ovary obovoid, with short, thick, divergent styles, ovules 12; capsule as long as the calyx; seeds 1.5 mm × 1.5 mm, with flat tubercles. Fl. Jul., fr. Aug.

Mountain plant, 900–3800 m alt., on calcareous, schist, and serpentine rocks.

a. var. *nabelekii*: Stem glandular-pubescent below; leaves glandular-pubescent, 1–2 cm long, 1–2 mm broad, mostly 3 pairs on each stem.

Type: Turkey: Wilayet Hakkari, distr. Cölemerik, Cilo Dagi, Nábelek s.n. 4 IX 1910 (BRNM), paratype: Wilayet Van: north-east of Van, Djezra, Nábelek 4111 (BRNM).

Geographic distribution: E. and S. Transcaucasia, E. Turkey, N. Iraq.

IRAQ: Irbil distr., Qandil mountains, Rechinger 11789 (W); Helgurd Mts., Rechinger 11460 (W); Qandil range, N.E. Raniyah, Rawi and Serhang 18257 (BAG, K), 26813 (K), and 26726 (K); N.E. of Qandil, Rawi and Serhang 24380 (K); Arl Gird Dagh, Guest and Ludlow-Hewitt 2873 (K); *ibid.*, Gillett 9615 (K).

b. var. *lipskyi* (Šiškin) Barkoudah stat. nov.

Basionym: *Gypsophila lipskyi* Šiškin, Candollea 3: 475 (1928); Komar., Fl. U.S.S.R. 6: 769 (1936); Blakelock, Kew Bull. 2: 398 (1948).

Plants completely glabrous, leaves papillose, not hairy, smaller than in the type var., 1 cm long and 1 mm broad, more numerous (4–5 pairs on each stem).

Type: Transcaucasia: Nakhichevan: Ganza, W. Lipskyi 26 (VI) 1893 (LE not seen), photo (K).

ARMENIA: distr. Megri, Xangezur near Buchlshar, Y. Karjagin s.n. 6 VIII 1932 (K).

66. *G. briquetiana* Šiškin, Candollea 3: 474 (1928).

Stock woody, branched; stems many, 5–8 cm high, much branched, glabrous; leaves congested at the stem base, linear, falcate, thick, acute, with scabrous margin and costa, 1–3 cm long, 1–2 mm broad, the cauline ones few, smaller, mostly 2–5 mm long; bracts small, subacute, scarios; inflorescence with 5–8 flowers, loose, corymbose; pedicels glabrous, about as long as the calyx; calyx campanulate, 3–3.5 mm long, with ovate obtuse mucronate lobes; petals light pink, rotundate, one and a half times as long as the calyx; ovary with 8 ovules; capsule and seeds unknown. Fl. Jul.

Type: Turkey: Wilayet Erzurum: Karakela, W. Saposhnikov and B. Šiškin s.n. 26 VII 1916 (TK, G-Deless. not seen), photo (K).

Geographic distribution: Only known from the type collection.

BLAKELOCK (1948) stated that a specimen of *G. nabelekii* from Iraq (Guest and Ludlow-Hewitt 2873 K) is intermediate between this species and *G. briquetiana*. This casts some doubt on the tenability of the latter species. Not having seen any material of it, I cannot venture to give an opinion.

67. *G. curvifolia* Fenzl, Pugill. Pl. Nov. Syr. 10 (1842); Boiss. Fl. Or. 1: 544 (1867).

Plate X, Fig. 10–17. p. 113

Stock woody, branched; stems numerous (5–20), erect, 10–50 cm high, slender (ca. 1.5 mm in diam.), glabrous, branched in the upper part, glaucous; leaves linear, triquetrous, congested at the stem base, few on the stem (3–5 pairs), acute, scabrous on margin and costa, 5–25 mm long and about 1 mm broad, with broadened base, glaucous; inflorescence a lax, small panicle of dichasia, 3–15 flowers, sometimes viscous by sessile glands, glandular-hairy; bracts lanceolate, mucronulate to acuminate, ciliate; pedicel longer than the calyx, to 1.5 cm long, glandular-hairy; calyx campanulate, 3–4 mm long with scattered glandular hairs, lobes ovate, mucronulate to apiculate, with sinuate edge; petals cuneate, white to pink, up to one and a half times as long as the calyx, with broad claw, truncate to shallowly emarginate, narrowed at the base; stamens shorter than petals, mostly unequal; ovary globose-obovoid, with short divergent styles; ovules 8; capsule nearly as long as the calyx, deeply four-valved; seeds 2 mm × 1.5 mm, with small acute tubercles. Fl. Jul., fr. Aug.

A plant of the subalpine zone, 1000–3660 m alt., growing on rocky slopes.

Type: Turkey: Toros Daglari, Kotschy 64 (G), isotype (K).

Geographic distribution: Turkey: Wilayet Adana, Konya, and Antalya.

Wilayet Adana: near Ermenek, Heldreich s.n. 1845 (FI, G, P); near Gulek Maden, Balansa 600 (G, JE); Bolkar Dag, near Bolkar Magara, Kotschy 172, and 204 (G-Boiss.); Amanos Mts., near Urfe, Siehe 266 (G, M, L, P); Toros Daglari, Boissier s.n. 1849 (FI); Karaisch, Buyar Dag, Davis 16847 (K); Wilayet Konya: S. Karanje derry, between Geyik Dag and Bozkir, Davis 14621 (E, K); Ermenek distr. Hamitseydi Bogaz-Beskuya, Davis 16249 (E, K); Karaman, near Kurash, W. Siehe 429 (M); Wilayet Antalya: distr. Gebiz, Bozburum Dag near Tozlu Cukur, Davis 15581 (E, K); S.E. Turkey, Siehe 150 (JE); Cappadocia: Aslan Dag, S.E. Mt. Agree?, Balansa s.n. 1856 (P).

This species may be compared with *G. spergulifolia* Griseb. of the Sect. *Gypsophila*. By their thin stems, their triquetrous leaves, their glandular-hairy indumentum, and the shape of their petals they are quite comparable. But the leaves of *G. curvifolia* have papillose edges, the calyx is larger, the calyx lobes are acuminate, not rotundate, and the ovules are only 4–8.

68. *G. libanotica* Boissier, Diagn. ser. 1: 12 (1842); Fl. Or. 1: 544 (1867); Post, Fl. Syr. Palest. ed 2: 166 (1932).

Plate X, Fig. 18–24. p. 113

Stock woody, branched, stems many (3–10), 12–35 cm high, (some, often lower, sterile), branched in the upper part, glandular-hairy above the nodes, more or less viscous by sessile glands; leaves linear-spatulate to linear-lanceolate, 1–3.5 cm long, 1–5 mm broad, acute to acuminate, glaucous, with prominent nerves, basal leaves close, the cauline ones few; inflorescence with many flowers; bracts triangular, acuminate, scarious; pedicel to 2 cm long, always longer than the calyx, glabrous; calyx campanulate, 3–4 mm long, with ovate-rotundate, ciliate lobes; petals one and a half times as long as the calyx, white to pink, oblong with broad claw, truncate to emarginate, narrowed at base; stamens shorter than the petals, mostly un-

equal; ovary globose, with short divergent styles; ovules 8; capsule shorter than the calyx about 2.5 mm long, deeply four-valved; seeds 1.5 mm  $\times$  1.5 mm, with flat tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

A mountain plant, growing at 1000–2500 m alt., on rocky calcareous slopes.

Type: Lebanon, Aucher 561 bis. Holotype (G-Boiss.), isotypes (FI, K).

Geographic distribution: North and Central Lebanon, Syria (Hermon Mt.), South-Central Turkey.

LEBANON: Between A'in el Asafir and Jisr el Hajar, G. Ehrenberg s.n. 1822 (K, L, P); Cedrus forests of Bsherry, Zerny s.n. 1931 (W); Sanin, Bornmüller 167 (JE, K, P); Yammouni to Diman, Blanche 2928 bis (JE, P); N. Merj Shin, above Hermel, Davis 9844 (E); Jabal Matrapheh, Stud. Rer. Nat. (1934) 13528 (HUJ); E. Tripoli, Elbarkowiyeh to Merj el Tawil, Olami s.n. (HUJ); Merj el Tawil to A'in Dib, Olami 13525 (HUJ); Hasroun, Blanche s.n. 1860 (P); Baalbek, Kotschy 348 (K, P). SYRIA: Antilebanon, Lowne 64 (E, K); Syria, Aucher s.n. 1833 (FI). TURKEY: Wilayet Iskenderun: Mt. Kusliji Dag, Amanus, Haradjian 568, 2522 and 4730 (W); Wilayet Adana: Bulkar Magar, Siehe 282 (JE, K); Bulkar Dag: from Jan-Chaula to Chaucha, Eig and Zohary 1350, 1353, and 1354 (HUJ); Bulkar Dag: Gisyil Deppe, Kotschy 4, 188, and 232 (BR, E, K, P); Wilayet Maras: distr. Göksun: Hohek Dag, Davis 20171 (Dodds Cetik) (E, K); Wilayet Kayseri: Masmen Dag, B. Balansa s.n. 1855 (P, K); Wilayet Malatya: Bey Dag, Haussknecht 1171 (JE, P).

This species is most closely related to *G. curvifolia* Fenzl; the stems are, however, glandular-hairy above the nodes, the leaves are broader, the seeds have flat tubercles. The areas of the species overlap in Turkey, but as far as I know have never been collected together.

69. *G. ruscifolia* Boissier, Diagn. ser. 1 (I): 12 (1842); Boiss., Fl. Or. 1: 546 (1867); Post, Fl. Syr. Palest. ed. 2: 166 (1932); Parsa, Fl. de l'Iran 1, (2): 1027 (1951).

Heterotypic synonym: *G. ruscifolia* Boiss. var. *latifolia* Post, l.c.; Type: Lebanon: Rasbaalbek, Post 73 (JE).

Plate X, Fig. 25–32. p. 113

Root thick, woody; stock branched, woody; stems many (3–15), woody at the base, 45–100 cm high, yellow, rigid, ca. 2 mm in diam., branched in the upper half, glabrous; leaves lanceolate to ovate, coriaceous, sessile, amplexicaul, acute to acuminate, 3–7 nerved, with prominent nerve-net, scabrous on the border and along the nerves, 1–2.5 cm long and about as broad, light green; inflorescence dichasial, paniculate, with very many flowers, sometimes glandular-hairy above the nodes; bracts linear, falcate, obtuse, with scarious edge; pedicel 3–10 mm long, sometimes glandular-hairy at the base; calyx campanulate, 2–2.5 mm long, with oblong erose lobes, with crowded calcium-oxalate crystals in the parenchyma; petals to one and a half times as long as the calyx, linear, rotundate, narrowed at base, with a broad claw; stamens as long as the petals; ovary globose, with long, divergent styles; ovules 8; capsule longer than the calyx, 3–3.5 mm long, deeply four-valved; seeds 2 mm  $\times$  2 mm with flat tubercles. Fl. Jun.–Jul., fr. Jul.–Aug.

On dry stony hills and slopes, and on mountains in *Quercus* forests, 500–1500 m alt.

Type: Iran, Aucher 550. Holotype (G-Boiss.), isotypes (FI, K).

Geographic distribution: N. Iran, N. Iraq, E. & S. Turkey, N. Libanon, Antilebanon in Syria.

IRAN: Prov. Tabriz: Between Sufian and Marand, 50 km N.W. of Tabriz, Rechinger 14896 (W); near Tabriz, Gilliat-Smith 2015 (K); Urmia along the R. Sher Chay, J. A. Knapp s.n. 1889 (JE). IRAQ: Prov. Mosul: near Zakho, Rechinger 10718 (W); between Dahuk und Ahmadiya, Rechinger 11576 (W); between Rayat and Haji Omran, Rechinger 11282 (W); Rawanduz, Mt. Handaran, Bornmüller 955 (BR, JE, K, P). TURKEY: Wilayet Mus: Bimgul near Gümğüm, Kotschy 316 (JE, K, L); Wilayet Van: Kara Dag, Kotschy 308 (E, K, P, W); Wilayet Diyarbakir: Elazig-Diyarbakir, 25 km from Maden, McNeill 483 (K, W); Maden-Ergani, Davis 22036 (E, K); Mardin, Sint 1110 (BM, BR, M); Wilayet Bitlis: Kotum, Davis 22411 (O. Polunin) (E, K); Wilayet Tunceli: south of Ovacik, Davis and Hedge D. 31530 (E); Gaziantep, Haussknecht 543 d. (JE, M, P). SYRIA: Antilebanon: Jabia, Davis 9926 (E); Bludan, Davis 10049 (E, K); Zabadani, Kotschy 237 (P); Aleppo, Th. Kotschy s.n. (P). LEBANON: Baalbek: Bsherry, Kotschy 312 (BM, K, P); Rasbaalbek, Post 73 (JE).

70. *G. damascena* Boissier, Diagn. ser. 1 (VIII): 57 (1849); Fl. Or. 1: 545 (1867); Post, Fl. Syr. Palest. ed. 2: 166 (1932).

Plate X, Fig. 33-40. p. 113

Stock woody, branched; stems many, 20-40 cm high, glabrous, glandular-hairy above the nodes, branched nearly throughout; leaves small, elliptic to lanceolate, acute, sessile, subamplexicaul, fleshy, leathery, 1-15 cm long and 3-4 mm broad, with prominent nerves; inflorescence a many-flowered panicle of twice-compound dichasia, lax; bracts ovate, acute to obtuse, scarious; pedicel to 1.5 cm long, mostly 5 mm long, glabrous; calyx campanulate, 2-2.5 mm long, with ovate, rotundate to emarginate lobes; petals white, linear, one and a half times as long as the calyx, rotundate, narrowed at base, the claw broader than the limb; stamens as long as the petals or shorter; ovary globose, with long, divergent styles; ovules 8; capsule exceeding the calyx, ca. 3 mm long; seeds 0.8 mm  $\times$  0.8 mm, with acute tubercles on the back. Fl. Jun., fr. Jul.

On dry hills and in fallow fields.

Type: Syria: Hills near Damascus (Kassioune?), Boissier s.n. 1846. Holotype (G-Boiss.), isotypes (K, P).

Geographic distribution: Syria: around Damascus and in the Syrian desert (endemic).

Damascus: W. of Damascus, near Mazzé, Gaillardot s.n. 1885 (P), N. Doumar along the river Barada, Gaillardot s.n. 1857 (JE), near Damascus, Rabweh, Gaillardot s.n. 1857 (JE), Wadi el Djouze, N. of Damascus, Gaillardot s.n. (JE), between Mazzé and Rabweh, Gaillardot s.n. 1855 (G.-Boiss.), around Damascus, Eig and Zohary 13502 (HUJ), Doumar, Peyron 69965 (P); Syrian desert: Qaryatayn to A'in al Bayda, Post s.n. 1900 (K).

PARSA (1951) recorded this species from Iran. Judging from the cited material I believe that *G. damascena* is endemic to Syria and does not extend to Iran.

71. *G. pallida* Stapf, Denkschr. Acad. Wien 281 (1886).

Heterotypic synonym: *Gypsophila Haussknechtii* Boiss., Fl. Or. Suppl. 86 (1888); Parsa, Fl. de l'Iran 1 (2): 1026 (1951); Type:

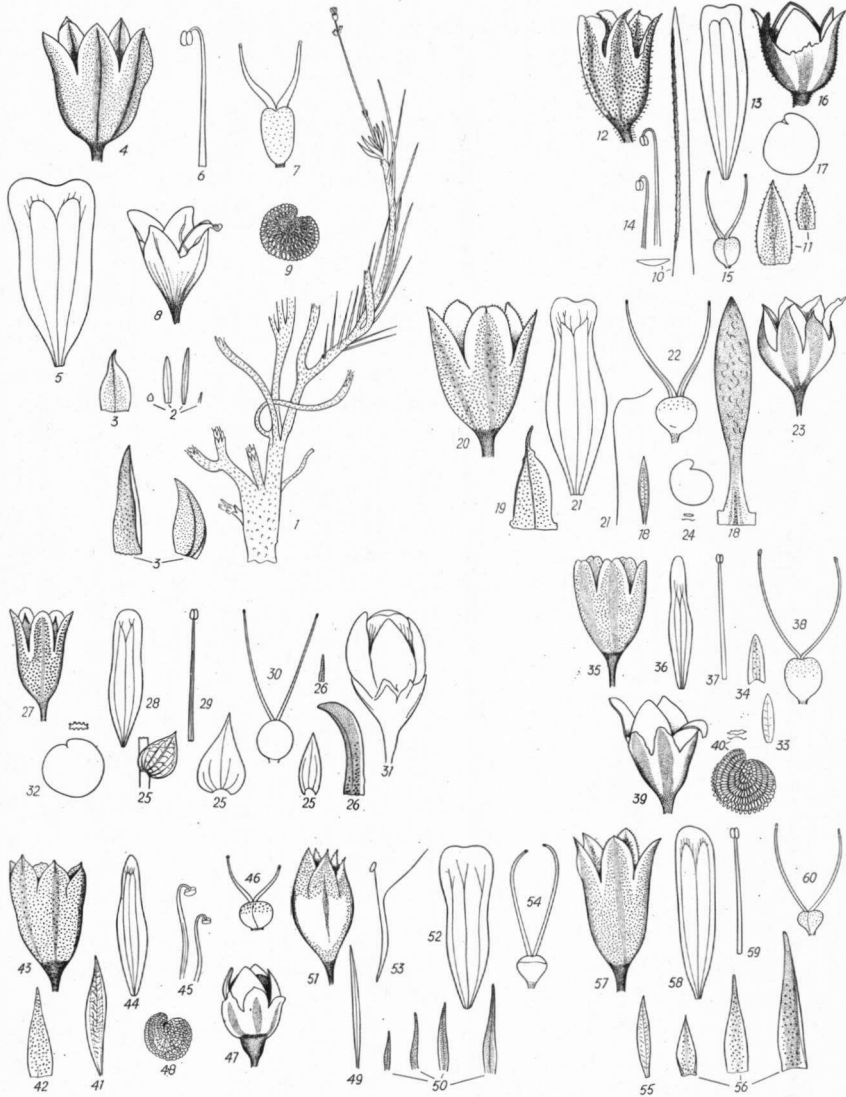


Plate X. Fig. 1-9: *G. nabelekii*; 1: caudex with one stem; 2: leaves; 3: bract; 4: calyx; 5: petal; 6: stamen; 7: ovary; 8: capsule; 9: seed. Fig. 10-17: *G. curvifolia*; 10: leaf; 11: bracts; 12: calyx; 13: petal; 14: stamens; 15: ovary; 16: capsule; 17: seed. Fig. 18-24: *G. libanotica*; 18: leaf; 19: bract; 20: calyx; 21: petal; 22: ovary; 23: capsule; 24: seed. Fig. 25-32: *G. ruscifolia*; 25: leaves; 26: bracts; 27: calyx; 28: petal; 29: stamen; 30: ovary; 31: capsule; 32: seed and a tubercle. Fig. 33-40: *G. damascena*; 33: leaf; 34: bract; 35: calyx; 36: petal; 37: stamen; 38: ovary; 39: capsule; 40: seed and a tubercle. Fig. 41-48: *G. pallida*; 41: leaf; 42: bract; 43: calyx; 44: petal; 45: stamens; 46: ovary; 47: capsule; 48: seed. Fig. 49-54: *G. aucheri* var. *aucheri*; 49: leaf; 50: bracts; 51: calyx; 52: petal; 53: stamen and petal; 54: ovary. Fig. 55-60: *G. pallidifolia*; 55: leaf; 56: bracts; 57: calyx; 58: petal; 59: stamen; 60: ovary

Iraq: Sinjar desert, between Sinjar and Tal 'Afar, Haussknecht 181 (JE) p. part.

Plate X, Fig. 41–48. p. 113

Stock woody, branched; stems many, ascending at the base, 30–60 cm high, whitish-glaucous, glabrous, branched in the upper part, glandular-hairy above the nodes; leaves lanceolate to linear-lanceolate, coriaceous, acute to acuminate, narrowed at base, with prominent veins, 1–3.5 cm long and 3–8 mm broad; inflorescence a very rich panicle of dichasia, rather dense; bracts deltoid to ovate, acuminate to apiculate, scarious; pedicel to 1 cm long, mostly about 5 mm long, glabrous; calyx campanulate, 2–3.5 mm long, with ovate, apiculate to obtuse, erose lobes; petals linear, to one and a half times as long as the calyx, rotundate to retuse, narrowed at base, with broad claw; stamens mostly longer than the petals, spreading; ovary globose to obovoid, with long, incurved styles; ovules 8; capsule longer than the calyx, ca. 2–3 mm long, with one or two seeds; seeds over 1 mm  $\times$  over 1 mm, with obtuse tubercles. Fl. Jun., fr. Jul.

On rocky, shaley, and dry slopes, up to 2000 m alt.

a. Var. *pallida*: Stem 30–50 cm high; leaves linear-lanceolate 3–6 mm broad; calyx 2–2.5 mm long.

Type: Iran: S.W.: Shiraz, Stapf s.n. 16 VI 1885 (W).

Geographic distribution: W. Iran, N. Iraq, and E. Turkey.

IRAN: Azna?, Koie 1384 (W); Radchird, Koie 1385 (W); Kuhrūd near Isfahan, Th. Strauss s.n. 1904 (JE); reported from Alburz, Qazvin, and from Mehran to Hamadan (Parsa l.c. 1959). IRAQ: Prov. Mosul: Kirkūk, 12 km E. Chemchemal, Gillett and Rawi 11609 (BAG, K); Jarmo near Chemchemal, Wheeler-Haines W. 358, and W. 266 (K); *ibid.*, Helback 1798 (K); Rawāndūz, Mt. Handarān, Bornmüller 954 (BR, JE, K, L). TURKEY: Wilayet Van: Çatak road, 2 km N. of Micingersuyn river, Davis 23242 (O. Polunin) (E, K); Çatak: Kavussahap Dag, Davis 23078 (O. Polunin) (E); Erdemit-Gevas, Davis 22658 (O. Polunin) (E); Wilayet Hakkari: Zab gorge, 30 miles S. of Baskale, Davis 23812 (O. Polunin) (E, K).

b. Var. *haussknechtii* (Boiss.) Barkoudah stat. nov.

Basionym: *Gypsophila haussknechtii* Boiss., Fl. Or. Suppl. 86 (1888) p.p. Misapplied name: *Gypsophila aucheri* auct. non Boiss.; Blake-lock, Kew Bull. 2: 193 (1957) p. part.

Stem taller, 50–60 cm, leaves distinctly lanceolate, calyx 3–3.5 mm long.

Type: Iraq: Sinjar desert: between Sinjar and Tall 'Afar, Haussknecht 181 (JE).

TURKEY: Prov. Maras: Durmali, Akker Dag, Manoog 1539, sterile (?) (E). IRAQ: Sinjar desert, between Sinjar and Tall 'Afar, Haussknecht 184 (K, P).

Geographical distribution: Only known from the last collections.

72. *G. aucheri* Boissier, Diagn. ser. 1: 12 (1842); Fl. Or. 1: 545 (1867).

Plate X, Fig. 49–54. p. 113

Stems several (3–7), slender, rigid, 30–40 cm high, branched in the upper half; internodes 2–4 cm long; leaves linear-lanceolate, narrowly

acuminate, 1–4.5 cm long and 1–3 mm broad, coriaceous, narrowed at base; inflorescence a rich panicle of dichasia, glandular-hairy, especially above the nodes; bracts linear, acuminate; pedicel to 7 mm long, mostly about 5 mm long; calyx campanulate-turbinate, 2–2.5 mm long and 1 mm wide, with ovate, acuminate lobes, edge minutely dentate, one and a half to two times as long as the calyx, spreading, cuneate, with broad, truncate to shallowly emarginate limb, pink, narrowed at base, with a shallow contraction between the limb and the claw; stamens shorter than the petals, erect; ovary obovoid, with long, divergent styles, ovules 8; capsule and seeds unknown. Fl. Jun.–Jul.

A mountain plant, to 1600 m alt., on shale slopes and banks.

a. *Var. aucheri*: Stem if glandular-hairy only above the nodes; pedicel and calyx glabrous; calyx lobes dentate, not ciliate.

Type: Turkey: (Cappadocia) along the Euphrates, Aucher 544. Holotype (G- Boiss. not seen), isotypes (FI, K, P).

Geographic distribution: Restricted to eastern and southern Turkey.

Wilayet Erzurum: between Tercan and Selepur, Davis and Hedge D. 30963 (E, K); Wilayet Rize: Rashtash along the Euphrates, Demir Dag, Sint 2991 (P); *ibid.*, near Kostu, Sint 1011 (BR, K); Wilayet Tunceli: Hozat, Davis and Hedge D. 31563 (E, K); Wilayet Bayburt: Kharput, Gümüşan, Sint 675 (BR, K, P); Wilayet Erzincan: Kivrighi, Bornmüller 3278 (K); Wilayet Maras distr. Elbistan, Nuruah Dag, Davis 20435 (Dodds, Cetik) (E); Akker Dag, Haussknecht s.n. 1865 (JE, P); Upper Euphrates, Aucher 542 (E); Turkey, Tchichatscheff 225 (P).

b. *Var. adenoclada* (Bornmüller) Barkoudah comb. nov.

Based on: *Gypsophila pallida* Stapf var. *adenoclada* Bornm., *Monit Jard. Tiflis* 29: 229 (1913).

Plants completely glandular-hairy in the upper part, not only above the nodes; pedicel and calyx glandular-hairy, calyx lobes ciliate.

Type: Turkey: Prov. Erzincan: Divriği, Bornmüller 3278 (JE).

TURKEY: Without exact loc., Aucher 544 p. part. (FI, G); Wilayet Rize: Rashtash along the Euphrates, Demir Dag, Sint 2991 (P); *ibid.*, near Costu?, Sint 1011 (RB, JE, K).

This species differs from the preceding one by its linear-lanceolate leaves, its linear bracts, its narrow campanulate-turbinate calyx, with ovate, acuminate not obtuse lobes, its pink petals with broad limb, and its obovoid ovary. The areas of these two species overlap in E. Turkey. It would be very interesting to investigate whether they show any difference of habitat.

73. *G. pallidifolia* Barkoudah sp. nov.

Plate X, Fig. 55–60. p. 113

Perennis, suffruticosa; caulibus numerosis, erectis, 30–40 cm altis, albis, tenuibus, ad basim glabris, supra glanduloso-pubescentibus et ramosis, internodiis 3–4 cm longis; foliis lineari-ellipticis, glaucoviridibus, acutissimis, ad basim angustatis, nervis salientibus, 2–3 cm longis et 2–3 mm latis; inflorescentia paniculato-dichasiali, glanduloso-pubescente; bracteis ovatis, acuminatis, margine scariosis; pedicellis glabris, 1–1.5 cm longis; calycibus campanulatis, 3–3.5 mm longis et

2 mm latis, quinquangularibus, costis salientibus, ad medium partitis, laciniis ovatis acutis, ciliatis, margine scariosis; petalis albis, oblongis, obtusis, calycem medio superantibus et 1 mm latis, ad basim angustatis; staminibus calyce aequilongibus; ovario obovoideo, quadrisulcato, stylis brevibus divergentibus; ovulis 4; capsula ignota.

Mountain meadows.

Type: Turkey: Wilayet Konya: Bolkar Dag, Maden, Siehe 388 (E).

The narrower inflorescence (branches departing under an angle of 30°), the larger calyx, the white, oblong petals without a constriction between claw and limb and the sulcate 4-ovulate ovary are characters by which *G. pallidifolia* may be distinguished from *G. aucheri*.

74. *G. virgata* Boissier, Diagn. ser. 1: 13 (1842); Fl. Or. 1: 545 (1867); Parsa, Fl. de l'Iran 1 (2): 1027 (1951).

Plate XI, Fig. 1-8. p. 120

Stock thick, woody, branched; stems several (3-10), erect, 40-60 cm high, glabrous, branched in the upper half, rigid, internodes 4-8 cm long; leaves lanceolate, mostly caducous, to 2 cm long and 1-2 mm broad, glaucous, acuminate; inflorescence a lax panicle of twice compound dichasia, glabrous; bracts lanceolate, acuminate, scariosus; pedicel less than one cm long, mostly 5 mm long, glabrous; calyx campanulate, about 2 mm long, with ovate, acute, ciliate lobes; petals oblong, about one and a half times as long as the calyx, truncate to shallowly emarginate, with a broad claw; stamens as long as the petals or shorter; ovary globose, with short incurved styles; ovules 8; capsule exceeding the calyx, ca. 2.5 mm long, deeply four-valved; seeds 1.5 mm × 1.5 mm, with obtuse tubercles. Fl. Jun.-Jul., fr. Jul.-Aug.

A mountain plant, up to 1700 m alt., on dry hills of metamorphic rocks.

Type: W. Iran, Aucher-Eloy 547. Holotype (G.-Boiss. not seen), isotypes (BM, K, P, W)!

Geographic distribution: W. Iran and E. Turkey.

IRAN: Prov. Shiraz: Nemek-Derja near Shiraz, Kotschy 456 (BM, FI, G, P); Isfahan, Aucher-Eloy 4269 (BM, FI, K, P); Arāk: Küh-e-Raswend, Th. Strauss s.n. 1903 (JE); Hamadan: Küh-e-Alwend-Khorremalerd, Th. Strauss s.n. 1903 (JE); Zirdn?, Th. Strauss s.n. 1892 (JE). TURKEY: Wilayet Erzincan: Kesis Dag above Cimin, Davis and Hedge D. 31683 (E, K); Wilayet Elāziğ: Elāziğ-Pertek, 12 miles from Elāziğ, Davis and Hedge D. 29167 (E, K); Cappadocia, along the Euphrates, Aucher 543 (FI); along the upper Euphrates, Montbret 2169 (FI) and 2364 (FI). SYRIA: Aleppo, Aucher-Eloy 554 (FI). I doubt the correctness of this last locality.

This species resembles *G. aucheri*, but the stems are rigid, quite glabrous, with longer internodes, the leaves are shorter and broader, the claw of the petals is broader than the limb, and the inflorescence has fewer flowers.

75. *G. transcaucasica* Barkoudah sp. nov.

Plate XI, Fig. 9-14. p. 120

Perennis, radice crassa; caulibus numerosis, erectis, tenuibus, ad basim glabris, superne glanduloso-pubescentibus, 30-50 cm altis,



dimidio superiore dichotomo-ramosis; foliis linearibus, 1–3 cm longis et 1–1.5 mm latis, obtusis, ad basim angustatis et connatis, carnosis; inflorescentia sublaxa, paniculato-dichasiali; bracteis lanceolatis, acuminatis, ciliatis, scariosis; pedicellis 1–1.5 cm longis, ad basim glanduloso-pubescentibus, capillaribus; calycibus late campanulatis, 3 mm longis et 2.5 mm latis, ad medium partitis, laciniis ovatis, obtusis, ciliatis; petalis roseis, oblongis, retusis vel leviter emarginatis, ad basim angustatis, calycem medio superantibus, ca. 1 mm latis; staminibus petalis brevioribus; ovario obovoideo, stylis divergentibus, ovulis 8. Fl. Jun.

On calcareous rubble slopes, ca. 1500 m alt.

Type: U.S.S.R.: Azerbaijan: Nakhichevan, between Karabaglyr and Aznabjurt, A. A. Grossheim, I. A. Iljinokaja and M. I. Kirpicnikov s.n. 7 VI 1947. Holotype (LE).

NAKHICHEVAN: between Dzhulfa and Darosham, Grossheim 20 (BM).

This species differs from *G. virgata* Boiss. by its linear, obtuse, fleshy leaves, its glandular-hairy inflorescence, its longer pedicels, its ciliate bracts and calyx lobes, and its wide-campanulate calyx with obtuse lobes. It seems to be very restricted in its distribution.

76. *G. aulieatensis* Fedtschenko in Knorring et Minkwitz, (the Vegetation of the district Aulieat, prov. Syr-Darja t. 30 186 (1912)); Šiškin in Komar., Fl. U.S.S.R. 6: 757 (1936).

Plate XI, Fig. 15–21. p. 120

Stock woody, branched; stems many, erect, slender (ca. 2 mm in diam.), glabrous, branched almost throughout, internodes 5–6 cm long; leaves narrowly oblanceolate, fleshy, acute, scabrous with subprominent veins, 1–3 cm long and to 4 mm broad; inflorescence a lax panicle of twice compound dichasia; bracts small, triangular, rotundate, the upper ones ciliate; pedicel 5–10 mm long, rigid; calyx narrowly campanulate, incised to the middle, 3 mm long and 1.5 mm wide, with ovate obtuse lobes, mostly ciliate; petals cuneate, truncate to rotundate, about one and a half times as long as the calyx, 1.5 mm broad; stamens shorter than petals; ovary ovoid, with long incurved styles, stigma oblong, terminal; ovules 4, nearly basal; capsule as long as the calyx or slightly longer; seeds 1.5 mm × 1 mm, with obtuse tubercles. Fl. Aug.–Sept., fr. Sept.–Oct.

On dry calcareous hills.

Type: U.S.S.R.: Kazakhstan: Syr Darya, Auliet, river Koktal, Knorring and Minkwitz s.n. 1912 (LE not seen).

KAZAKHSTAN: Muyun-Kum, near Aschli Kul lake, Granitov s.n. 23 X 1927 (E).

This species differs from the related species *G. virgata* by its more or less oblanceolate leaves and calyx lobes, its longer calyx, its cuneate petals, its few ovules (4) and its larger seeds with flat tubercles and its obtuse bracts and calyx lobes. Geographically it is isolated from the other members of subsect. *Suffruticosae*.

Subsection E. *Coarctatae* Williams p. 42

77. *G. ericalyx* Boissier, Diagn. ser. 1, (I): 13 (1842); Fl. Or. 1: 546 (1867).

Heterotypic synonym: *Acanthophyllum mite* Fisch. et Mey., Ann. Sc. Nat. ser. 4 (I): 35 (1845); Boiss., Fl. Or. 1: 566 (1867) as species dubia. Type: Turkey: Tchichatscheff 707 (P).

Plate XI, Fig. 22–30. p. 120

A glaucous perennial subshrub; stems few, erect, puberulent to pubescent, 20–40 cm high, branched, lower shoots mostly sterile, internodes 3 cm long; leaves linear, flat or triquetrous, 1–3 cm long and 1–2.5 mm broad, puberulent or glabrous, fleshy, mostly bearing tufts of leaves in their axils; inflorescence dense, hirsute; bracts lanceolate, scarious; pedicel to 5 mm long, mostly as long as the calyx, capillary, hirsute, with patent eglandular hairs; calyx campanulate, 2–2.5 mm long, hirsute, incised to one-third, with ovate, acute to obtuse lobes, with aggregated large calcium oxalate crystals in the parenchyma; petals oblong, one and a half times as long as the calyx, truncate to shallowly emarginate, white, spreading, with a shallow contraction between the limb and the claw; stamens shorter than petals, erect, sometimes shorter than the calyx, with swollen glandular base; ovary globose, with long spreading styles, stigmatose on their upper inner side; ovules 4–8; capsule globose, surrounded by the calyx, 1.5 mm long, not dehiscent, with two seeds; seeds 1 mm × 1 mm, with flat tubercles. Fl. Jun.–Sept.

On gypsum steppes.

a. Var. *eriocalyx*: Stem glabrous; leaves triquetrous, 1–1.5 mm broad, pedicel to 5 mm long; ovules mostly 4.

Type: Turkey: Cappadocia, along the Euphrates, Aucher 558. Holotype (G-Boiss.), isotypes (BM, FI, K, P).

Geographic distribution: C. Turkey.

TURKEY: Wilayet Adana: Niğde, near Tarbas, Siehe 184 (BM, E, K, P), *ibid.*, near Ouloukikhla, Siehe 307 (BM, JE); Wilayet Kayseri: between Sivas and Kayseri, Bornmüller 1690 (BM, BR); Serefli Koçhisar, Birana and Bikasapligil 693 (HUJ); Wilayet Erzincan: Kuruçay, Sint 2003 (BR, K); Wilayet Sivas: Zara-Sivas, Stainton and Henderson 5788 (E); Wilayet Ankara: E. of Tuz, near Mezkit, Beng and Wagenitz 353 (B); above Tuz Gölü, 25 km N. of Koçhisar, McNeill 330 (E, K); 135 km S. of Ankara, Birand and Zohary 3004 (HUJ).

b. Var. *henrici* (Czecz.) Barkoudah stat. nov.

Basionym: *G. henrici* Czecz., Acta Soc. Bot. Polon. 9: 33 (1932).

Plant puberulent; leaves flat, linear, 1–2.5 mm broad; pedicel not over 2.5 mm long; ovules 6–8.

Type: Turkey: Prov. Çankiri: between Çankiri and Tukht, Czeczott 196. 299.5. (KRAM).

TURKEY: Prov. Çankiri: Çakmakli-dere, J. and F. Bornmüller 13324 (BM, JE), 13325 (K, P) and 13326 (BM, P), 10 km S. of Çankiri, Davis 25063 (E, K) and 21749 (E).

78. *G. lepidioides* Boissier, Diagn. ser. 1 (I): 14 (1842); Fl. Or. 1: 546 (1867).

Plate XI, Fig. 31–36. p. 120

Very similar to the preceding species but puberulent throughout

by short patent hairs; leaves lanceolate to linear-lanceolate, 2–3 cm long and 2.5–5 mm broad; pedicel nearly absent; calyx with shorter hairs than in *G. eriocalyx*; ovules 4.

On dry gypsum hills.

Type: Turkey: Cappadocia, along the Euphrates, Aucher 559. Holotype (G-Boiss.), isotypes (K, P).

Geographic distribution: Turkey: Wilayet Erzincan.

Kuruçay, near Hassanor, Sint 1010 (BR), East Cappadocia, De Montbret 2385 (FI, P).

#### 7. Section *Heterochroa* (Bunge) Fenzl p. 42

79. *G. cerastioides* D. Don, Prod. Fl. Nep. 213 (1825); Edgew. & Hooker f., Fl. Brit. India 1: 217 (1855).

Homotypic synonym: *Timaeosia cerastioides* (D. Don) Klotzsch, Bot. Ergeb. Waldem. Reise 138, t. 33 (1862).

Plant caespitose, hirsute, hairs eglandular; stems numerous, 5–15 (–35) cm high, slender, simple, internodes 5–50 mm, leaves spatulate, acute to subobtusate or mucronate, ciliate, hirsute, 1–4 cm long and 5–10 mm broad; inflorescence dichasial, lax, about 5 to 20 flowers; pedicel to 1 cm long, mostly longer than the calyx; bracts leafy; calyx wide-campanulate hirsute, 5-fid, with lanceolate, mucronate to acuminate lobes, 3–5 (–7) mm long and as wide or wider; petals oblanceolate, shallowly emarginate or with sinuate apex, narrowed at base, one and a half to two times as long as the calyx, white with purple veins; stamens shorter than the petals, exserted; ovary ovoid with short parallel styles, 2 rarely 3; ovules 20–24; capsule mostly not dehiscent, ovoid, many-seeded; seeds 0.7 mm × 0.7 mm, with small flat tubercles. Fl. May–Jul.

A mountain plant, 1500–4000 m alt.

Type: Nepal: Gosaingthan, M. Wallich, Cat. n. 644. Holotype (K. Hooker herb.), isotypes (E, G).

Geographic distribution: Throughout the southern slope of the Himalayas: N. Pakistan (N. W. Frontier Prov., Chitralh); Kashmir; N. India (Punjab); Nepal; Sikkim; Pakistan (East Bengal).

KASHMIR: above Gulmarg, Duthie 11296 (BM, E, K). PUNJAB: near Simla, Fleming s.n. (E). N. W. INDIA: Hooker f. (E, FI, G, K, L, M, P, W); *ibid.*, Duthie 623 (G). W. NEPAL: Pito Korlo, J. M. Mailey s.n. 1936 (E, G). SIKKIM: Hooker f. (E, FI, G, K, L, M, P, W). CALCUTTA: Chumbi, Dungbo s.n. (BM, M).

80. *G. desertorum* (Bunge) Fenzl in Ledeb., Fl. Ross. 1: 292 (1842); Komar., Fl. U.S.S.R. 6: 740 (1936).

Basionym: *Heterochroa desertorum* Bunge, Supplem. Alt. 29 (1836). Plate XI, Fig. 37–44. p. 120

Root thick, woody; stems 5–15 cm high, ascending, glandular-puberulent, slender, simple; leaves linear-subulate, 4–5 mm long and 1 mm broad, keeled at base, acute, glandular-puberulent, sometimes falcate; inflorescence dichasial, with 3–10 flowers; bracts leafy, keeled; pedicel 3–12 mm long; calyx campanulate, 3.5–5 mm long

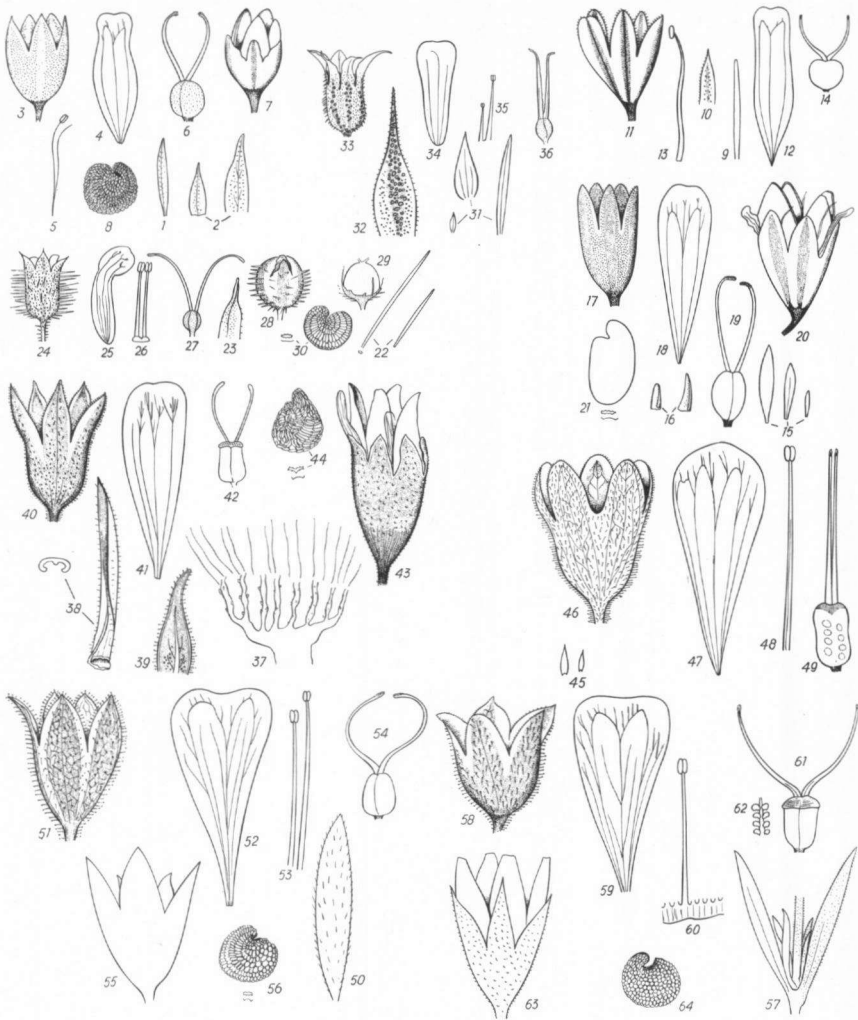


Plate XI. Fig. 1-8: *G. virgata*; 1: leaf; 2: bracts; 3: calyx; 4: petal; 5: stamen and petal; 6: ovary; 7: capsule; 8: seed. Fig. 9-14: *G. transcaucasica*; 9: leaf; 10: bract; 11: calyx; 12: petal; 13: stamen; 14: ovary. Fig. 15-21: *G. aulicatenensis*; 15: leaves; 16: bracts; 17: calyx; 18: petal; 19: ovary; 20: capsule; 21: seed and its tubercle. Fig. 22-30: *G. eriocalyx* var. *eriocalyx*; 22: leaves; 23: bract; 24: calyx; 25: petal; 26: stamens; 27: ovary; 28-29 capsule; 30: seed and its tubercle. Fig. 31-36: *G. lepidoides*; 31: leaves; 32: bract; 33: calyx; 34: petal; 35: stamens; 36: ovary. Fig. 37-44: *G. desertorum*; 37: caudex; 38: leaf and its cross-section; 39: bract; 40: calyx; 41: petal; 42: ovary; 43: capsule; 44: seed and a tubercle. Fig. 45-49: *G. violacea*; 45: leaves; 46: calyx; 47: petal; 48: stamen; 49: ovary. Fig. 50-56: *G. glandulosa*; 50: leaf; 51: calyx; 52: petal; 53: stamens; 54: ovary; 55: capsule; 56: seed and a tubercle. Fig. 57-64: *G. sericea*; 57: stem node with leaves; 58: calyx; 59: petal; 60: stamen; 61: ovary; 62: placenta; 63: capsule; 64: seed

and 2–3 mm wide, glandular-puberulent, incised to the middle, with ovate lobes, with narrow scarious border, acute to obtuse; petals oblanceolate, 1.5–2 times as long as the calyx, truncate to shallowly emarginate, narrowed at the base, white on the upper side, purplish on the lower side; stamens shorter than the petals; ovary obovoid with short divergent styles, stigma slightly swollen; ovules 20–24; capsule exceeding the calyx, ca. 4 mm long; seeds 1.2 mm  $\times$  1 mm, with curved obtuse rugae. Fl. Jun.–Jul.

On stony semidesert soil and on rocks.

Type: U.S.S.R.: West Siberia: Altai: along the river Tshuya, Al. Bunge s.n. 1832. Holotype (LE not seen), isotypes (L, P).

Geographic distribution: U.S.S.R.: (West Siberia: Altai; Tuva Republ.); Mongolia; N. China.

ALTAI: Oyrotya, Kachagar valley, river Cuy, S. of Kochag-Agaga, A. V. Kalinina, L. A. Soklova and B. K. Šiškin s.n. 1937 (LE); Cui steppe, B. Šiškin, L. Cilikina and G. Sumnevic s.n. 1931 (LE); Altai, without exact loc., Chaffanjon 1310 (P); between Koch-Agotsh and Tarchatta river, Krylov s.n. 1901 (K). MONGOLIA: Ulu Ken river, Dyacoul, Price 481 (K); Kalgan, N. M. Przewalski s.n. 1871 (K); Kirghiz-nor, G. N. Potanin s.n. 1879 (K); Ordos, near Kuku-hotou, Changai, G. N. Potanin s.n. 1886 (G, FI). GOBI: G. N. Potanin s.n. 1886 (P); without exact loc., Ledebour s.n. (P), Fischer s.n. 1859 (P). N. CHINA: without exact loc., Licent, R.P. 13707 (P).

This species can easily be distinguished from other members of this group by its linear-subulate, keeled leaves, small flowers, glandular-puberulent indumentum and curved rugae on the seeds.

81. *G. violacea* (Ledeb.) Fenzl in Ledeb., Fl. Ross. 1: 291 (1842); Komar., Fl. U.S.S.R. 6: 739 (1936).

Basionym: *Arenaria violacea* Ledeb., Mém. de l'Acad. des Scien. de St. Petersb. 5: 533 (1815); Ledeb., Icon. Pl. Fl. Ross. 5: t. 416 (1834). Plate XI, Fig. 45–49. p. 120

Densely caespitose; root woody; stems numerous, ascending, 5–10 cm high, slender, branched above, everywhere pubescent, glandular-pubescent above, internodes ca. 1 cm long; leaves small, ovate to lanceolate, 5–10 mm long and 1–4 mm broad, sessile, acute to obtuse, glabrous or more or less puberulent; inflorescence dichasial, lax; bracts leafy, mostly glandular-pubescent; pedicel 5–10 mm long, glandular-pubescent; calyx wide-campanulate, 5–6 mm long, glandular-pubescent, incised to the middle, with ovate obtuse lobes; petals oblanceolate, 1.5–2 times as long as the calyx, white to lilac, rotundate, tapering at the base; stamens shorter than the petals; ovary short-cylindric, with long, parallel styles, ovules 16; capsule as long as the calyx; seeds 1.5 mm  $\times$  1.5 mm. Fl. Jun.–Jul.

On rocks, stony and rubble hills, and on gravel, up to 1800 m alt.

Type: U.S.S.R.: Far East: Okhotsk: Yablonov Mts., near the city Okhotsk, Redowsky. Holotype (LE not seen).

Geographic distribution: U.S.S.R.: Far East (Kamchatka, Okhotsk, Ussuria, and Sakhalin).

KAMCHATKA: M. de Chamisso s.n. 1826 (G). SAKHALIN island: Kirav, basin of the river Poronya, S. of the river Onora (Opora), O. A. Majroka s.n. 1950 (LE); Ajan, Filing 54 (FI, P); Maradan, A. M. Fischer s.n. 1949 (LE); near Asen, Polong 54 (LE).

82. *G. glandulosa* (Boiss.) Walp., Rep. 2 Suppl. 1: 774 (1843); Boiss., Diagn. ser. 1 (VIII): 59 (1849); Fl. Or. 1: 539 (1867); Komar., Fl. U.S.S.R. 6: 737 (1936).

Basionym: *Heterochroa glandulosa* Boiss., Diagn. ser. 1 (I): 15 (1842).

Plate XI, Fig. 50–56. p. 120

Plant everywhere glandular-pubescent; stems numerous, prostrate or ascending, 5–20 cm long, slender; internodes as long as or shorter than the leaves, simple or branched above; leaves small, the basal ones spatulate, the upper ones elliptic, acute to obtuse, 5–10 mm long and 1–3 mm broad; inflorescence dichasial, below the inflorescence a few additional solitary axillary flowers; bracts leafy; pedicel equalling to or one and a half times as long as the calyx; calyx wide-campanulate 4.5–6 mm long, nearly as wide, cleft to the middle, with ovate, acute lobes; petals oblanceolate, one and a half times as long as the calyx, bilobed to shallowly emarginate, purple-pink; stamens shorter than the petals; ovary ovoid with short divergent styles, stigmatic surface oblong; ovules 20–24; capsule shorter than the calyx, ca. 4 mm long; seeds 1 mm × 1 mm, with flat tubercles. Fl. Jul.–Sept.

On stony slopes in the alpine and subalpine zone, ca. 1800 m alt.

Type: Turkey: Wilayet Rize (Lazistan), Aucher-Eloy 630. Holotype (G), isotypes (BM, K, P).

Geographic distribution: U.S.S.R.: Caucasus; W. Transcaucasia. Kartšchal massif, Salatcur Mts., lower valley of the river Nakra. Turkey: Wilayet Rize.

TURKEY: Wilayet Rize: (Lazistan). Distr. Hemsin: Ortakoy-Çat, Davis 21205 (Dodds) (E, K); Çat, Fortunadere river, B. Şişkin s.n. 1917 (BM); between Bayburt and Trabzon, Montbret s.n. (K).

83. *G. sericea* (Ser.) Krylov, Fl. Sibir. Occ. 5: 1087 (1931); Beih. Bot. Centralbl. 59 B: 458 (1939); Komar., Fl. U.S.S.R. 6: 739 (1936).

Basionym: *Arenaria sericea* Seringe in DC., Prod. 1: 414 (1824); this last is based on *Arenaria purpurea* Willdenow ex Schlecht., Ges. Naturf. Fr. Berl. Mag. 7: 211 (1813), non *Arenaria purpurea* Persoon (1801).

Homotypic synonym: *Arenaria rubicunda* Spreng., Syst. Veg. 2: 399 (1825) nom. superfl.

Heterotypic synonyms: *Heterochroa petraea* Bunge in Ledeb., Fl. Alt. 2: 131 (1830); Ledeb., Icon. Fl. Ross. illustr. 2: t. 155 (1830); *Gypsophila petraea* (Bunge) Fenzl in Ledeb., Fl. Ross. 1: 291 (1842), non Reichenbach (1830). Type: U.S.S.R.: West Siberia, Altai, Bunge s.r. 1836 (BR, M, P); *Gypsophila bungeana* Dietr., Syn. Pl. 2 (1841). Type: the same as the last.

Plate XI, Fig. 57–64. p. 120

Plant prostrate, bearing long stolons, these 10–35 cm, with roots on the nodes, glandular-pubescent; stems numerous, 5–10 cm long, slender, internodes not over 1.5 cm long; leaves linear-lanceolate, small, acute to obtuse, 5–15 mm long and 1.5–4 mm broad, sessile; flowers solitary, axillary; bracts leafy; pedicel to 2 cm long, capillary;

calyx wide-campanulate, 4–5 mm long, glandular-hairy, cleft to the middle, with ovate obtuse lobes; petals one and a half to two times as long as the calyx, oblanceolate, white to lilac; stamens shorter than the petals; ovary ovoid, with long, incurved styles, ovules 16; capsule as long as the calyx; seeds 1.3 mm  $\times$  1 mm, with flat tubercles. Fl. Jun.–Aug.

On rocks and stony hills.

Type: Bieberstein from Siberia is an authentic specimen (B-Willd.).

Geographic distribution: U.S.S.R.: (E. Siberia: Altai); Mongolia.

ALTAI: Ledebour s.n. 1836 (BR, LE). KAZAKHSTAN: Ustjkamenogorsk, Ataman Mt., B. Šiškin and G. Sumnevic s.n. 1931 (LE); Katun river, between Katanda and Turgunde, Krylov s.n. 1901 (LE). TOMSK region: Zmeinogorsk distr., and in Semipalatsinsk region: distr. Ustjkmenogorsk, W. Š. Iljin s.n. 1909 (L). MONGOLIA: Kaudaget? Potanin 1876 (G). CENTRAL ASIA: without exact loc., Chaffajon 1305 (P).

This species can readily be distinguished from other members of the section *Heterochroa* by its linear-lanceolate, glandular-pubescent leaves, solitary flowers, long pedicel, and round tubercles on the seeds.

84. *G. microphylla* (Schrenk) Fenzl in Ledeb., Fl. Ross. 1: 291 (1842); Komar., Fl. U.S.S.R. 6: 740, t. 46, f. 5 (1936).

Basionym: *Heterochroa microphylla* Schrenk, Enum. Pl. Nov. Soong. 1: 92 (1841).

Plate XII, Fig. 1–7. p. 127

Root thick, woody; stems many, prostrate, slender, more or less branched, 5–10 cm long, densely leafy; leaves lanceolate, subcarnose, acute to obtuse, narrowed at base and sessile, papillose on their surface and margin, with short shoots in their axils, 3–7 mm long and 1–2 mm broad; inflorescence terminal, dichasial, many-flowered; bracts leafy; pedicel 3–5 mm, papillose; calyx campanulate, 3–3.5 mm long, papillose, cleft to the middle, with ovate obtuse lobes, their edge narrowly scariosus and ciliate; petals oblanceolate, one and a half times as long as the calyx, emarginate to shallowly bilobed, purple to white, stamens shorter than the petals; ovary ovoid with short, divergent, incurved styles; ovules ca. 12; capsule as long as the calyx; seeds 1 mm  $\times$  1 mm, with flat tubercles. Fl. Jun.–Jul.

On stony hills in the alpine zone, 2000–3000 m alt.

Type: U.S.S.R.: Kazakhstan: Alatau, Tarbagatai Mts., Schrenk s.n. 1840. Holotype (LE not seen), isotypes (BR, P).

Geographic distribution: U.S.S.R.: Middle Asia (Dzungaria); Tarbagatai (Dzungarian Alatau); Tien Shan: Talgar.

DZUNGARIAN ALATAU: Kapalj region, Semirec, Lipsinsko along the river Dzilasai (at the mouth of the river Tentek) coll.? (LE). TIEN SHAN: Talgar-gorges in Transilian, A. Regel s.n. 1880 (K, LE).

85. *G. turkestanica* Šiškin, Trav. Mus. Bot. Acad. Sc. U.S.S.R. 24: 38 (1932); Komar., Fl. U.S.S.R. 6: 743 (1936).

Stems numerous, prostrate, branched, 4–12 cm long, slender, glabrous; leaves linear, 4–8 mm long and 1–2 mm broad, subtriquetrous, single-nerved, glabrous, narrowed at the base, rather obtuse, with tufts of smaller leaves in their axil; flowers solitary in

the axils of the upper leaves; pedicel capillary, 5–10 mm long; calyx wide-campanulate, 2.5–3 mm long, cleft nearly to the middle, with broadly ovate, obtuse lobes, scarious on the border; petals purple, one and a half to two times as long as the calyx, oblanceolate, truncate; ovary with 16–18 ovules; capsule exceeding the calyx; seeds 1 mm  $\times$  1 mm, smooth. Fl. Jul.

On stony hills in the alpine zone.

Type: U.S.S.R.: Middle Asia: Tien Shan, Alexandrov Mts., between the rivers Tshatshke and Terek, M. Iljin s.n. 20 VII 1930 (LE; not seen, nor any other collection). The description is compiled from the cited literature.

This species differs from the closely related *G. microphylla* (Schrenk) Fenzl by being completely glabrous, having longer leaves, broadly ovate calyx lobes, a longer pedicel, and smooth seeds.

86. *G. sedifolia* Kurz, *Flora* 55: 285 (1872); Edgew. & Hooker f. *Fl. Brit. India* 1: 217 (1855).

Plate XII, Fig. 8–13. p. 127

Root thick, woody; stems many, 5–10 cm high, ascending or erect, slender, internodes 1–3 cm long, puberulent; hairs eglandular; leaves linear, obtuse, 5–15 mm long and 1–2 mm thick, fleshy, with small leaf-tufts in their axils, puberulent; inflorescence terminal, dense, dichasial, subcapitate, with ca. 10 flowers; bracts leafy; pedicel shorter than calyx, nearly absent; calyx campanulate-turbinate, coriaceous, cleft to the middle, with ovate, acute lobes, puberulent, 3.5–4 mm long and 3 mm wide; petals hardly longer than the calyx, white, oblanceolate, sinuate to emarginate at the apex, narrowed at the base, 4 mm long and 2 mm broad; stamens nearly as long as the petals, mostly unequal; ovary globose-ovoid, with short parallel styles; ovules 12–14; capsule as long as the calyx or slightly longer; seeds 1.2 mm  $\times$  1.2 mm, with flat tubercles. Fl. Jul.–Aug.

On gneiss rocks and rocky slopes, 1000–4500 m alt.

Type: Himalayas: Kashmir; Zanskar, Kurz. Holotype (B, destroyed), isotype (CAL not seen).

Geographic distribution: N.E. Afghanistan; Kashmir; India.

AFGHANISTAN: Kabul region: Paghman Mts., Neubauer 371 (W); Paghman, Cousinia, Volk 927 (W); Paghman Mts., Samlakh Mt., Thesiger 211 (W); Paghman valley, Neubauer 219 (W); Paghman Mts. N. Kotal-i-Kotandar, Gilli 1240a. (W). CHITRALH: Ghuthar (Gilfgir), Bowes Lyon 68 (BM); Bang Gol N. of Mastut, Stainton 3062 (BM); Barum Gol, Wendelbo 1950 (BM). KASHMIR: Baltistan, Shingo valley, Duthie 11883 (BM, E, FI); Rabila, Ladakh, Koelz 6129 (G); Zanskar, Hooker f. & Thomson (L).

This species differs from *G. herniarioides* Boiss. by having puberulent, mostly eglandular stem, leaves and calyx, linear-subulate leaves, broad, white to pale pink petals hardly longer than the calyx, and 12–14 ovules.

87. *G. herniarioides* Boissier, *Fl. Or. Suppl.* 84 (1888); Komar., *Fl. U.S.S.R.* 6: 743 (1936).

Heterotypic synonym: *G. pseudoverticillata* Komar., *Trav. Soc.*



Natural. Pétersb. 26: 123 (1896). Type: Turkestan: Zadafshan Mts, Kamarov s.n. 1893 (LE not seen), isotype (K)!

Plate XII, Fig. 14–21. p. 127

Root thick, woody; stems numerous, prostrate, about 5 cm long, slender, lower part covered with whitish scales, upper part glaucous, glandular-puberulent; internodes less than 1 cm long; leaves small, oblong to spatulate, 4–8 mm long and 0.5–3 mm broad, obtuse, with short shoots in their axils, glandular-puberulent; inflorescence dichasial, dense, subcapitate, with 3–20 flowers; pedicel 0.5–2 mm long; bracts leafy, with scariosus base; calyx campanulate-tubiform, 3.5–8 mm long and 2–3 mm wide, glandular-hairy, incised to  $\frac{1}{4}$ th or  $\frac{1}{5}$ th, with triangular acute teeth, scariosus on the border; petals linear-cuneate, white with purple veins, one and a half to two times as long as the calyx; stamens as long as the petals, spreading; ovary ovoid, with long parallel styles; ovules 4–12; capsule as long as the calyx tube, few-seeded; seeds 1.5 mm  $\times$  1 mm, with flat tubercles. Fl. Jun.–Aug.

On stony slopes and gravel accumulations, 1800–3600 m alt.

Type: Afghanistan: Kurrum valley, Sikaram, J. E. Aitchinson 961. Holotype (G-Boiss. not seen), isotype (K).

Geographic distribution: U.S.S.R. (Middle Asia: Pamir-Alai); Afghanistan and Chitralh (Pakistan).

PAMIR-ALAI: Feriansk region: Osh, S. of Kaljta-dozzi, Fedtschenko and Roshevitz 93 (LE). ALAI: between Sary-mogol and Bargad, Lipchitz s.n. 1931 (LE). BUKHARA: Karategin, Lipsky s.n. 1897 (M). PAMIR: Ak-Baital, O. A. and B. A. Fedtschenko s.n. 1901 (K). PAKISTAN: Chitralh: Sara Larhu, Bowes Lyon 1093 (BM); Chomarkan pass E. of Mastot, Stainton 3278 (BM).

88. *G. antoninae* Šiškin, Act. Inst. Bot. Acad. Sc. U.S.S.R. ser. 1, fasc. 3: 180 (1837); Komar., Fl. U.S.S.R. 6: 744 (1936).

Heterotypic synonym: *G. porphyrantha* Rechinger f. et Aellen, Bot. Jahrb. 75: 356 (1952). Type: Iran: Prov. Khurasan, Mt. Hazar Masdjid, between Cash and Tolgor, Rechinger 5173 (W)!

Plate XII, Fig. 22–26. p. 127

Root thick, woody, 4–10 mm thick; stems many, with prostrate base, ascending above, 5–15 cm long, glandular-puberulent, slender, rigid, brittle, internodes under 2 cm; leaves linear, 5–10 mm long and 0.5–1 mm broad, acute, glandular-puberulent, subcarnose, with smaller leaf-tufts in their axils; inflorescence terminal, subcapitate, 1–2.5 cm in diam., with 3–15 flowers; bracts leafy, scariosus at base, shorter than the calyx; pedicel to 3 mm long, mostly absent; calyx campanulate-tubiform, 4.5–6 mm long and 2.5 mm wide, glandular-pubescent, incised to  $\frac{1}{4}$ th or  $\frac{1}{3}$ rd, the teeth lanceolate, acute to obtuse, scariosus on the edge, green bands as broad as the scariosus intervals between them; petals linear-cuneate, one and a half times as long as the calyx, light to dark purple; stamens nearly as long as the petals, spreading; ovary ovoid, with short, divergent styles; ovules 8–12. Fl. Jun.–Jul.

On rubble slopes, 1000–1500 m alt.

Type: Turkmenia: Kopet Dag, Kyzyl-chasar, Antonina Borissova s.n. 27 VI 1934 (LE not seen), paratype: Gaudan, Alexandrov 29 (LE).

Geographic distribution: Kopet Dag range, in Turkmenia and N. Iran.

C. Kopet-Dag: near Almagzuk, Murad-Kerrik Mt., T. P. Nadeschina s.n. 1954 (LE).

Differs from the closely related *G. herniarioides* Boiss. by its woody caudex, rigid stems, glandular-pubescent inflorescence, linear, acute leaves, and purple flowers.

## 8. Section *Dichoglottis* Boissier p. 43

### Subsection A. *Drypidipetala* Williams p. 43

89. *G. melampoda* Bien. ex Boiss., Fl. Or. 1: 551 (1867); Parsa, Fl. de l'Iran 1 (2): 1034 (1951).

Plate XII, Fig. 27-34. p. 127

Annual to perennial herb with a single erect stem, 15-30 cm high, lower internodes pubescent or glabrous, branched in the upper part; leaves oblanceolate to linear-oblanceolate, rotundate, narrowed and connate at the base, 1-2.5 cm long and 2-6 mm broad, glaucous; inflorescence lax, dichasial; pedicel to 3 cm long, mostly recurved after anthesis; bracts linear, obtuse, leafy; calyx widely campanulate, 2-2.5 mm long and as wide, incised almost to the middle, with semi-circular lobes, more or less sinuate, scarious intervals very narrow; petals oblanceolate, rotundate, angustate at the base, with a shallow contraction between limb and claw, about one and a half times as long as the calyx, white; stamens shorter than the petals; ovary globose, with short, divergent styles; ovules about 20; capsule longer than the calyx, deeply four-valved, seeds 1.2 mm  $\times$  0.8 mm, with small flat tubercles. Fl. Apr., fr. May.

In cultivated and fallow fields.

Type: Iran: Between Teheran and Isfahan, near Sof, Bunge s.n. May 1859. Holotype (P).

Geographic distribution: Iran: Central and Southern part.

IRAN: Between Yezd and Kerman, Bunge s.n. 1859 (K, L, P); between Aghda and Isfahan, Bunge s.n. (K); between Aghda and Yezd, Bunge (K).

Note: BLAKELOCK (Kew Bull. 2: 192 (1957)) suggested that *G. melampoda* is conspecific with *G. alsinoides* Bunge. It seems to me that this is due to an error Blakelock made when typifying the first species. There are two collections by Bunge from the same locality; one is a paratype of *G. melampoda* (April 1859), the other a paratype of *G. alsinoides* (month? 1859). *G. melampoda* is a valid species of *Gypsophila*; *G. alsinoides* belongs in *Arenaria* where it requires a new name: *Arenaria bungei* Barkoudah, nom. nov. (based on *Gypsophila alsinoides* Bunge; not *Arenaria alsinoides* Willd.).

90. *G. heteropoda* Freyn et Sint, Bull. Herb. Boiss. ser. 2 (III): 865 (1903). Parsa, Fl. de l'Iran 1 (2): 1034 (1951); Siškin in Komar., Fl. U.S.S.R. 6: 767 (1936).



Plate XII. Fig. 1-7: *G. microphylla*; 1: leaves; 2: calyx; 3: petal; 4: stamen; 5: ovary; 6: capsule; 7: seed. Fig. 8-13: *G. sedifolia*; 8: caudex with one stem; 9: leaves; 10: petal; 11: ovary; 12: capsule; 13: seed. Fig. 14-21: *G. hermarioides*; 14: leaf; 15: bract; 16: calyx; 17: petal; 18: stamen and petal; 19: ovary; 20: capsule; 21: seed. Fig. 22-26: *G. antoninae*; 22: leaves; 23: calyx; 24: petal; 25: stamen; 26: ovary. Fig. 27-34: *G. melampoda*; 27: stem node; 28: leaves; 29: calyx; 30: petal; 31: stamens; 32: ovary; 33: capsule; 34: seed. Fig. 35-43: *G. heteropoda* ssp. *heteropoda*; 35: basal part of a plant; 36: leaf; 37: bract; 38: calyx; 39: petal; 40: stamen; 41: ovary; 42: capsule; 43: seed and embryo. Fig. 44-49: *G. heteropoda* ssp. *minutiflora*; 44: leaves; 45: bracts; 46: calyx; 47: petal; 48: stamens; 49: ovary. Fig. 50-57: *G. pseudomelampoda*; 50: leaves; 51: bract; 52: calyx; 53: petal; 54: stamen; 55: ovary; 56: capsule; 57: seed.

Heterotypic synonym: *G. nanella* Grossh. et Šiškin, Pl. Orient. exs. Fasc. 1: 8 (1924). Type: Transcaucasia: Nakhichevan, Grossheim 9 (BM, K).

Plate XII, Fig. 35–43. p. 127

Annual herb; stem slender, erect, 5–30 cm high, branched in the upper part, more or less viscous, with sessile glands or glandular-hairy; leaves linear-lanceolate to linear, obtuse, narrowed and connate at the base, subcarnose, 1–3.5 cm long and 1–3.5 mm broad; inflorescence laxly dichasial; pedicel capillary, 1–2.5 cm long; bracts triangular, acute, scarious; calyx wide-campanulate, about 2–2.5 mm long and as wide, with ovate, acute or rotundate lobes, scarious at the border, scarious intervals narrow; petals linear-cuneate, about one and a half times as long as the calyx, truncate, shallowly emarginate or sinuate at the apex, narrowed at the base, white; stamens shorter than the petals; ovary ovoid, styles divergent, short, stigmatose in the upper part; ovules about 12–16, capsule hardly exceeding the calyx; seeds 0.7 mm  $\times$  0.7 mm with flat tubercles.

On sandy hills and subdesertic sandy soil.

a. *ssp. heteropoda*: Stem 10–30 cm high; glabrous, viscous, with sessile glands; leaves 2–3.5 cm long, 2–3.5 mm broad; pedicel 1–2.5 cm long; calyx lobes obtuse; ovules 12. Fl. Apr., fr. May.

Type: U.S.S.R.: Turkmenia: Krasnovodsk, on sandy hills, Sint 1532. Holotype (W), isotypes (BM, E, K, L, LE).

Geographic distribution: U.S.S.R. (Transcaucasia, Nakhichevan, Azerbaijan; Kazakhstan: Aral-Caspian region; Turkmenia: Kara Kum, Kyzyl Kum); N. Iran (Guilan: Manjil); Afghanistan (Badghis); Iraq (along the Euphrates); E. Turkey.

AFGHANISTAN: Badghis, Hari-rud valley, Aitchinson 576 (W). IRAN: Chama Mt. Nesskiep?, Sint 1045 (K). IRAQ: Ar-Ramadi, Graham 160 (W); Karbala, 2 km West of Karbala, Gillett 6370 (K); Al Basrah: Jabal Sanam, Graham 420 (W), 5 km East of As-Salman, Gillett and Rawi 6189 (K); Samarra, G. A. Watson s.n. 1919 (K).

*ssp. minutiflora* Barkoudah *ssp. nov.*

Misapplied names: *G. heteropoda* auct. non Freyn et Sint; Bornmüller, Fedde Repert. Beih. 89: 104 pro part. (1940); Handel-Mazzet., Ann. Hofmus. Wien 26: 151 (1912).

Plate XII, Fig. 44–49. p. 127

Herba laxe glanduloso-pubescens, 5–10 cm alta; foliis 1–2.5 cm longis et 2 mm latis; pedicellis 5–15 mm longis; bracteis facie dorsali glanduloso-pubescens; petalis albis, oblongis, retusis vel leviter emarginatis; ovulis 16. Fl. May, fr. Jun.

On gypsum slopes.

Type: Turkey: Wilayet Sivas: near Zara, J. Bornmüller 3279. Holotype (P), isotype (K).

Geographic distribution: North Turkey.

Wilayet Sivas: near Sivas, Bornmüller 1970 (JE); Kangal, Stainton 8481 (E); between Zara and Sivas, Stainton and Henderson 5331 (E); Wilayet Çankiri: Çakmakli valley, Bornmüller 13329 (E).

This species differs from *G. melampoda* Bien. by its viscous or glandular-hairy

upper internodes, narrower leaves, shorter pedicel, triangular scarios bracts, ovoid ovary, long stigmatic surface, and 12–16 ovules.

91. *G. pseudomelampoda* Gauba et Rechinger f., Fedde Rep. 48: 39 (1940); Parsa, Fl. de l'Iran 1 (2): 1036 (1951).

Plate XII, Fig. 50–57. p. 127

Perennial; stem glabrous, branched throughout, 40–70 cm high; leaves linear-spatulate, acute, narrowed at base and connate, 2–4 cm long and 1–4 mm broad; inflorescence dichasial, highly compound; bracts leafy, linear; pedicel to 2.5 cm long, usually 1.5 cm long; calyx campanulate 2–2.5 mm long and 1.5 mm wide, with semi-circular, rotundate lobes, scarios intervals four times narrower than the green bands; petals linear, cuneate, sinuate, one and a half times as long as the calyx; stamens as long as the calyx; ovary globose, with short, incurved styles; ovules 12; capsule as long as the calyx; seeds 1 mm  $\times$  0.7 mm, with obtuse tubercles. Fl. May, fr. Jun.–Jul.

On hills and mountains.

Type: Iran: Elburz: near Karaj Mt. Pic Kul and Mt. Halkedar near Murdabad, Rechinger 1055. Holotype (W), isotypes (E, K).

Geographic distribution: This species is only known from N. Iran.

IRAN: Prov. Qazvin: Halkadar near Murdabad, Rechinger 6793 (W); Ravandeh near Karaj, Gauba Sebeti 2164 (W).

This species differs from *G. melampoda* Bien. by its perennial habit, narrower acute leaves, sinuate petals, and 12 ovules.

92. *G. diffusa* Fischer et Meyer ex Ruprecht, Fl. Cauc. 180 (1869); Šiškin, Trav. Mus. Bot. Acad. Sc. U.S.S.R. 24: 35 (1932) descr. emend.; Komar., Fl. U.S.S.R. 6: 753 (1936).

Misapplied name: *G. elegans* auct. non M.B. Fl. As. Med.

Plate XIII, Fig. 1–8. p. 131

Perennial; root thick, yellow; stems few, ascending to erect, glaucous, branched throughout, 10–30 cm high, glabrous below, glandular-puberulent in the inflorescence; basal leaves spatulate, 1.5–2 cm long and 3–5 mm broad, sometimes glandular-puberulent, obtuse, the cauline ones linear-lanceolate, acute; inflorescence laxly dichasial; pedicel capillary, 1–2 cm long, sometimes glandular-puberulent; bracts lanceolate, scarios; calyx wide-campanulate, 2–2.5 mm long, glabrous to glandular-pubescent, with ovate, obtuse lobes; petals white, one and a half times as long as the calyx; ovary ovoid with divergent short styles; ovules 8; capsule globose, as long as the calyx; seeds 1 mm  $\times$  1 mm, with flat tubercles. Fl. Apr., fr. May.

On stony, mostly calcareous hills.

Type: U.S.S.R.: Kazakhstan: E. coast of the Caspian Sea, Karelín. Holotype (LE not seen), isotype (FI).

Geographic distribution: U.S.S.R.: (Transcaucasia: Nakhichevan, Sadarak?; Kazakhstan: Aral-Caspian region; Turkmenia: Kara Kum) N. Iran.

TURKMENIA: North coast of Aral Sea, Bunge 184 (P). KAZAKHSTAN: Mangyshlak, A. Becker s.n. (P). IRAN: South of Tehran, Qum, Th. Strauss (JE); between Isfahan and Tehran, near Kohrud, A. Bunge s.n. 1859 (P).

93. *G. adenophora* Boissier et Buhse, Nov. Mém. Soc. Nat. Mosc. 12: 35 (1860); Boiss., Fl. Or. 1: 550 (1867).

Plate XIII, Fig. 9–16. p. 131

Perennial, glandular-hispidulous; stems few, rigid, brittle, 10–30 cm high, branched throughout, branches spreading; leaves linear-subulate, obtuse, glandular-hairy, 1–2 cm long and 1–2 mm thick; inflorescence lax, glandular-hairy, with capillary axes; bracts linear, leafy, obtuse; pedicel ca. 1 cm long, glandular-hairy; calyx wide-campanulate 2.5–3 mm long and 2 mm wide, parted to the middle, with triangular, acute to obtuse lobes, green bands, glandular-hairy, as broad as the scarious intervals; petals linear-cuneate, one and a half times as long as the calyx, emarginate to bilobed; stamens as long as the petals, spreading; ovary ovoid; styles short, divergent; ovules about 12; capsule as long as or shorter than the calyx, deeply four-valved; seeds 1 mm × 0.8 mm, with flat small tubercles. Fl. and fr. May.

Type: Iran: Mt. Soh near Isfahan, Buhse s.n. 21 May 1849. Holotype (G-Boiss. not seen), isotype (P).

This species is only known from the type collection which is a fragmentary specimen.

94. *G. mucronifolia* Rechinger f., Fedde Repert. 48: 40 (1940); Parsa, Fl. de l'Iran 1 (2): 1029 (1951).

Plate XIII, Fig. 17–21. p. 131

This species resembles in many respects *G. adenophora*. It differs in the following characters:

Glandular-hairy only in the basal part; leaves mucronate, subspiny, puberulent; pedicel and calyx glabrous or with scattered hairs; petals truncate or rotundate; ovules 16.

On desertic gypsum soil.

Type: Iran: Prov. Damghan-Semnan, near Surkkeh, Rechinger 1239. Holotype (W), isotype (K); topotypes: Rechinger 9793 (W), D. E. Gauba s.n. 1937 (BR).

This species is only known from its type locality. More ample collections of it and of *G. adenophora* may show that these two species are not separable. Neither Rechinger nor Parsa noticed the close similarity between these two species.

95. *G. szovitsii* Fischer et Meyer ex Fenzl in Ledeb., Fl. Ross. 1: 289 (1842); Walp., Rep. 2: 774 (1843), (errone: Scovitsii); Boiss., Fl. Or. 1: 550 (1867); Šiškin in Komar., Fl. U.S.S.R. 6: 756 (1936).

Homotypic synonym: *G. szovitsii* var. *glabra* Fenzl in Ledeb., Fl. Ross. 1: 289 (1842).

Plate XIII, Fig. 22–29. p. 131

Perennial; root woody, ca. 3 mm thick; stems few, erect, branched from base to top, 20–50 cm high, glandular-puberulent in the lower part, specially above the nodes, glabrous above; leaves linear, acute,

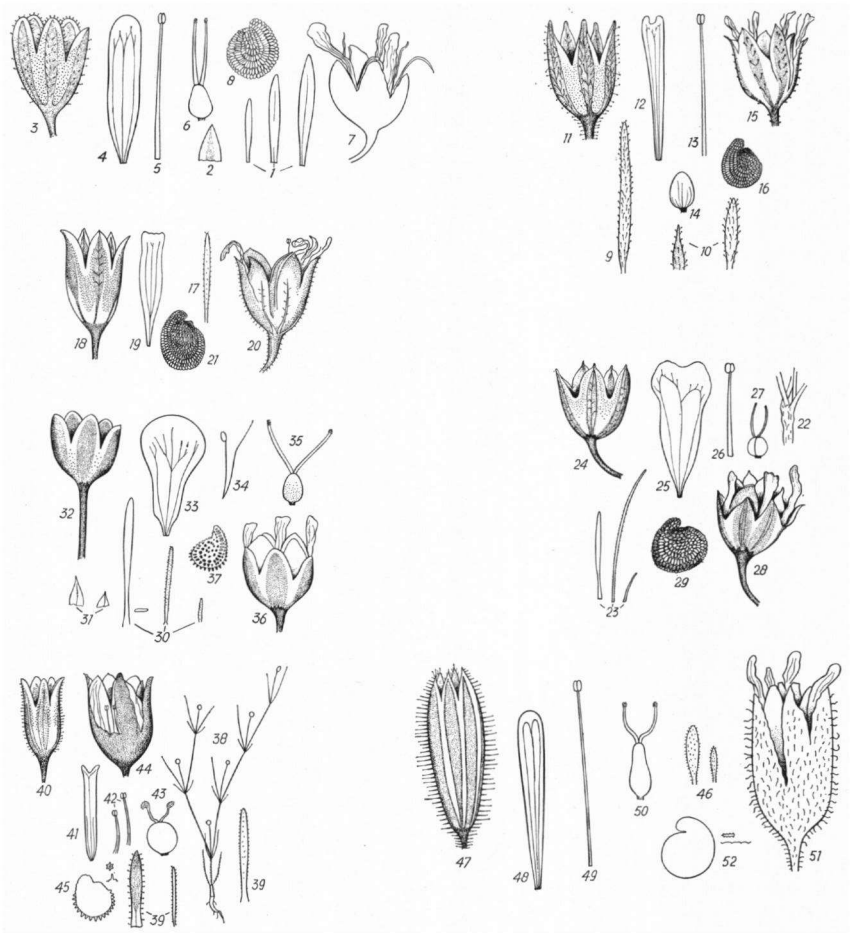


Plate XIII. Fig. 1-8: *G. diffusa*; 1: leaves; 2: bract; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed. Fig. 9-16: *G. adenophora*; 9: leaf; 10: bracts; 11: calyx; 12: petal; 13: stamen; 14: ovary; 15: capsule; 16: seed. Fig. 17-21: *G. mucronifolia*; 17: leaf; 18: calyx; 19: petal; 20: capsule; 21: seed. Fig. 22-29: *G. szovitsii*; 22: caudex; 23: leaves; 24: calyx; 25: petal; 26: stamen; 27: ovary; 28: capsule; 29: seed. Fig. 30-37: *G. parva*; 30: leaves; 31: bracts; 32: calyx; 33: petal; 34: petal and stamen; 35: ovary; 36: capsule; 37: seed. Fig. 38-45: *G. linearifolia*; 38: a whole plant; 39: leaves; 40: calyx; 41: petal; 42: stamens; 43: ovary; 44: capsule; 45: seed and a tubercle. Fig. 46-52: *G. spatulifolia*; 46: leaves; 47: calyx; 48: petal; 49: stamen; 50: ovary; 51: capsule; 52: seeds and a tubercle

fleshy, more or less glandular-puberulent, 1–3 cm long and 0.5–2 mm broad, the upper ones small, filiform; inflorescence lax, dichasial-paniculate; pedicel capillary, 1–2.5 cm long, glabrous; bracts linear, leafy, small; calyx wide-campanulate, 2 mm long and as wide, lobes ovate, apiculate, glabrous, green bands as broad as the scarious intervals between them; petals oblanceolate, one and a half times as long as the calyx, emarginate, with a shallow contraction between the limb and the claw, pink; stamens hardly longer than the calyx; ovary globose; styles short, divergent; ovules 12–16; capsule as long as the calyx; seeds 0.8 mm × 0.8 mm, with obtuse tubercles. Fl. May–Aug.

On clay hills.

Type: U.S.S.R.: Transcaucasia: Checheno-Ingush A.S.S.R.: Kurechay Mt. near Elizabethpol, R. F. Hohenacker s.n. 1839. Holotype (LE), isotypes (BM, K, L).

Geographic distribution: U.S.S.R.: Transcaucasia: Georgia, Armenia, Azerbaijan, Nakhichevan.

GEORGIA: near Elizabethpol, S. Fedosseff s.n. (FI). OSSETIA: Candogar s.n. 1887 (FI). ARMENIA: Yerevan, A. Grossheim s.n. 1919 (JE); *ibid.*, Szovits 129 (BM, K, L). NAKHICHEVAN: near Bezoghlyban along the river Aras, Woronow 464 (K). AZERBAIJAN: Karabakh, Hohenacker s.n. 1839, paratype (LE). IRAQ: Mesopotamia, Aucher 551 (FI). It is doubtful whether this last locality is correct.

96. *G. parva* Barkoudah sp. nov.

Plate XIII, Fig. 30–37. p. 131

Herba annua, glauco-viridis, glabra vel glanduloso-pubescentis, tota ramosa, dichotoma vel trichotoma, internodiis 2–3 cm longis, 10–20 cm altis, superioribus viscosis; foliis linearibus, obtusis, haud connatis, plus minusve glanduloso-pubescentibus, carnosius, 1–4 cm longis et 1–3 mm latis; inflorescentia dichasialis, semel ad ter composita; bracteis triangularibus, minutis, scariosis; pedicellis 3–16 mm longis, capillaribus, ad basim glanduloso-pubescentibus; calycibus campanulato-globosis, ad medium partitis, laciniis ovatis, obtusis, margine anguste scariosis, 1.5–2 mm longis et 2 mm latis; petalis albis, oblanceolatis, rotundatis, ad basim angustatis, calycem medio superantibus, patentibus; staminibus calyce longioribus; ovario globoso; ovulis ca. 12; capsula globosa, calyce longiore; seminibus echinatis, margine hilo opposita subapplanata. Fl. May–Jun.

On gypsum hills.

Type: Turkey: Wilayet Çankiri, S. of the town, Davis 21731. Holotype (E), isotype (K).

Geographic distribution: Endemic to Turkey.

TURKEY: Wilayet Çankiri: near the town, Davis 21526 (E, K); Wilayet Kuruçay: Mt. near Nerskiep, Sint 1045 (JE).

The differences between this species and *G. szovitsii* are the following: Always annual, upper part viscous; pedicel shorter than 1 cm; bracts scarious, calyx lobes rotundate, green bands broader than intervals; petals rotundate; seeds with acute tubercles. *G. parva* also resembles *G. heteropoda* ssp. *minutiflora* Bark., but the fleshy leaves, the rotundate petals, the ovoid ovary with 12 ovules, and the sharply echinate seeds differentiate it readily from the last-mentioned taxon.



97. *G. linearifolia* (Fisch. et Mey.) Boissier, Fl. Or. 1: 550 (1867); Šiškin in Komar., Fl. U.S.S.R. 6: 772 (1936).

Basionym: *Dichoglottis linearifolia* Fisch. et Mey., Ind. Hort. Petr. 1: 26 (1835).

Homotypic synonym: *Gypsophila szovitsii* Fisch. et Mey. var. *glandulosa* Fenzl in Ledeb., Fl. Ross. 1: 289 (1842).

Heterotypic synonym: *Gypsophila trichopoda* Boiss., Diagn. ser. 1, 1: 10 (1842); Claus, Ind. in Göbel. It. 2: t. 2, f. 1 (1838). Type: Turkey: Upper Euphrates (Cappadocia), Aucher-Eloy 585 (BM, Fl, G-Boiss., P).

Plate XIII, Fig. 38–45. p. 131

Annual herb, 5–25 cm high, branched throughout; stem thin, glandular-puberulent; leaves linear, fleshy, 1–3.5 cm long and 1–2.5 mm broad, mostly puberulent, obtuse; inflorescence dichasial, lax; bracts linear, leafy, obtuse; pedicel capillary, 1–2 cm long, glabrous; calyx campanulate, about 2 mm long and 1 mm wide, glandular-puberulent, incised to the middle, with oblong ovate lobes, narrowly scarious-bordered, obtuse; petals linear, white, up to one and a half times as long as the calyx, bilobed to emarginate; stamens shorter than the calyx, mostly unequal, with slender filiform filaments; ovary globose, with short, divergent styles, stigmatic surface oblong, terminal; ovules 12–24; capsule globose, as long as the calyx; seeds many, 0.5 mm × 0.5 mm, with narrow acute tubercles. Fl. Jun., fr. Jul.

On gypsum hills and in desertic steppes.

Type: U.S.S.R.: East shore of the Caspian Sea, Karelin (LE not seen).

Geographic distribution: U.S.S.R. (Great Russia: Lower Volga, Upper Tobol; Kazakhstan: Aral-Caspian region); Turkey (Upper Euphrates); Iraq (Mosul region, Desert); Iran (Central desert).

U.S.S.R.: LOWER VOLGA: (Simbirsk) Chuvash, Meyer s.n. (K); Kazan, Kittary s.n. (P). SOUTH RUSSIA: Ledebour s.n. 1836 (P). CASPIAN SEA region: Claus s.n. 1834 (P). TURKEY: Upper Euphrates, Bieberstein 2330 (Fl); *ibid.*, Montbret s.n. (P). IRAQ: eastern part, near Sinjar, Haussknecht 185 (JE, K, P); along the Euphrates: between Anah and Hith, Th. Strauss s.n. 1894 (JE); Mosul region: near Kirkuk, Bornmüller 958 (JE), 12 km N.W. of Kirkuk, Eig and Zohary 13529 (HUI), Qaiyarah near Mosul, Bayliss 104 (K); Basra region: between Kuwaibada and Ar-Rumail, 38 km W. of Basra, Eig and Zohary 13530 (HUI); on the way from Baghdad to Aleppo, Olivier and Bruguièr s.n. (P). IRAN: Prov. Ahvaz: N.E. Haft Gel, Bent and Wright 503–413 (W); Prov. Isfahan: Mt. Kuh-i-Kohrud near Isfahan, Th. Strauss s.n. 1909 (JE). Chah-Bazan? Kœie 345 (W).

Note: On the label of Bayliss 104 it is noted that this plant inhabits dry saline soil; apparently it is the only species that grows in such conditions.

This species differs from *G. parva* Bark. by its non-viscous stems, longer pedicels, leafy bracts, narrow, glandular-puberulent calyx and bilobed petals.

98. *G. spathulifolia* (Fisch. et Mey.) Fenzl in Ledeb., Fl. Ross. 1: 290 (1842); Boiss., Fl. Or. 1: 552 (1867); Šiškin in Komar., Fl. U.S.S.R. 6: 773 (1936).

Basionym: *Dichoglottis spathulifolia* Fisch. et Mey., Ind. Hort. Petr. 1: 26 (1835).

Homotypic synonym: *Saponaria spathulifolia* (Fisch. et Mey.) Vved., Fl. Uzbekistan 2: 426 (1953).

Plate XIII, Fig. 46–52. p. 131

Very similar to the preceding species. Annual; stem 7–15 cm high; leaves spatulate or oblong-spatulate, 2–2.5 cm long and 6–10 mm broad, subpetiolate, hairy, with eglandular and glandular hairs; flowers solitary, axillary; pedicel 3.5–7 mm long, swollen at the end; calyx long-campanulate, 5–7 mm long and to 3 mm wide, incised to the middle, lobes oblong, subobtusate, with narrow scarious border; petals white, one and a half times as long as the calyx, linear-spatulate, bilobed or emarginate; stamens (rarely 5) as long as the calyx; ovary with 15 to 20 ovules; capsule narrowly ovoid, hardly exceeding the calyx; seeds 1 mm × 1 mm, with obtuse tubercles. Fl. May.

On stony hills.

Type: Eastern shore of the Caspian Sea, Fischer and Meyer s.n. (LE not seen).

Geographic distribution: U.S.S.R.: Kazakhstan; Aral-Caspian region.

KAZAKHSTAN: Amu-Daryinskij region, Syr-Darya distr., along the river Amu-Darya, Krashennnikov 187 (LE).

Subsection B. *Purpureae* Barkoudah p. 44

Series 1. *Elegantes* Šiškin p. 44

99. *G. elegans* M. Bieberstein, Fl. Taur. Cauc. 1: 319 (1808); Fenzl in Ledeb., Fl. Ross. 1: 290 (1842); Boiss., Fl. Or. 1: 551 (1867), ex part; Šiškin in Komar., Fl. U.S.S.R. 6: 764 (1936).

Heterotypic synonym: *G. producta* Stapf in Denkschr. Acad. Wien: 280 (1886). Type: Cult. in Hort. Bot. Vindob. (not seen); *G. ceballosii* Pau and Vicioso, Bol. Soc. Esp. Hist. Nat. 19: 493 (1919). Type: Spain, Escorial near Madrid, L. Ceballos s.n. 9: 1918 (MA)!

Plate XIV, Fig. 1–6. p. 138

Annual or biennial herb; stem 12–60 cm high, glabrous, glaucous, branched in the upper part; leaves oblong-lanceolate to linear-lanceolate, 2–4 cm long and 2–5 mm broad, the basal ones trinervate; inflorescence lax, dichasial; pedicel capillary, 1–3 cm long; bracts deltoid, scarious; calyx campanulate, 2.5 × 3.5 mm long and as wide, incised to the middle; lobes ovate, rotundate; scarious intervals twice broader than the green bands; petals white to pink, with purple veins, oblong, one and a half to three times as long as the calyx, emarginate, narrowed at the base; stamens shorter than the petals, spreading; ovary short-cylindrical; styles short, divergent, ovules 12–16; capsule exceeding the calyx; seeds 1.2 × 1.2 mm; hilum surrounded by a collar, tubercles obtuse. Fl. Jun., fr. Jul.

On stony hills, gravel banks, and in fields.

a. var. *elegans*: Annual; stem 10–40 cm high; petals two to three times as long as the calyx, not more than 1.5 mm broad.

Type: Caucasus: Terek: Kasbek, M. Bieberstein s.n. (LE).

Geographic distribution U.S.S.R.: (Black Sea region (Odessa), Crimea (Feodosia), Caucasus, Transcaucasia); E. Turkey; Iran (Caspian Sea region); adventive in W. Europe and N. America.

IRAN: Aucher-Eloy, 4271 a. (FI, P); Sefirud valley, near Rudbar, J. and A. Bornmüller 6332 (JE, P); Elburz, Minghi-tan, Kukurtli valley, Sommier and Levier 164 (FI). TURKEY: Wilayet Diyarbakir: Diyarbakir-Ergani, 20 km from Diyarbakir, Davis and Hedge D. 28814 (E, K); Wilayet Elaziğ: along the Euphrates, Aucher 539 (BM, FI, P); Wilayet Erzincan: Sipikor Dag, Sint 1172 (FI, JE, P); Kesis Dag above Cimin, Davis and Hedge D 31638 (E, K); Wilayet Erzurum: Horasan-Karaugan, 17 miles from Horasan, Davis and Hedge D. 29496 (E, K); Wilayet Tunceli: Pülümür-Mutu, 1 km above Pülümür, Huber-Morath 11136 (HUJ); Wilayet Bitlis: 8 km N. of Bitlis, Frödin 144 (W); Wilayet Kars: Ardahan, Davis and Hedge D. 30428 (E, K). TRANSCAUCASIA: Georgia, Hohenacker s.n. 1835 (L, M, P). KUBAN: near Utekhalan, Sommier and Levier, 164 (FI). ADJARIA: Mt. Khivo, Alboff 262 (FI). AZERBAIJAN distr. Khizy, near Alty-Agach, C. Gurvitsch s.n. 1935 (B).

b. Var. *latipetala* Barkoudah var. nov.: Biennis, 50–60 cm alta, petalis calyce dimidio langioribus, 4 mm longis et 2 mm latis.

Type: Turkey: Wilayet Erzincan: Selepur-Tercan, Davis and Hedge D. 29309. Holotype (E), isotype (K).

Geographic distribution: E. Turkey and Transcaucasia.

TRANSCAUCASIA: Georgia: near Kala, Sommier and Levier 164 (FI).

100. *G. silenoides* Ruprecht, Fl. Cauc. 1: 182 (1869); Šiškin in Komar., Fl. U.S.S.R. 6: 764 (1936).

Heterotypic synonym: *G. capillipes* Freyn et Sint in Freyn, Oest. Bot. Zeitsch. 41: 363 (1891). Type: Turkey: Wilayet Trabzon, Gümüsane; Karavel Dag, P. Sint 7283 (BM, JE, L).

Misapplied name: *G. elegans* auct. non M. Bieb.; Boiss., Fl. Or. 1: 551 (1867), quoad plantas perennes.

Plate XIV, Fig. 7–15. p. 138

Perennial herb; stems 3–10, tufted, glaucous, glabrous, 10–25 cm high, branched in the upper part, prostrate to ascending; leaves linear-spatulate to linear-oblong, 2–6 cm long and 2–8 mm broad, acute to obtuse, glaucous; inflorescence lax, dichasial; pedicel capillary, 1–3.5 cm long; bracts triangular, acuminate, scarious; calyx campanulate, 3–4 mm long and 2.5 mm wide, incised to the middle; lobes ovate, acute to obtuse; green bands narrower than the scarious intervals; petals oblong, 2–3 times longer than the calyx, white with purple veins, emarginate to shallowly bilobed, angustate at the base; stamens shorter than the petals, divergent, with purplish anthers; ovary short-cylindrical; styles short, divergent, ovules 12–16; capsule globose, as long as the calyx; seeds 1 mm × 1 mm, with small flat tubercles. Fl. Jul., fr. Aug.

On lime screes, rocky banks, and slopes, in *Fagus* scrub, and on alpine pastures, 1400–2200 m alt.

Type: Armenia, Szovits 158. Holotype (LE), isotypes (K, L, P).

Geographic distribution: N. E. Turkey, Caucasus, Transcaucasia.

TURKEY. Wilayet Trabzon: Gümüsane, Sint 6104 (BM, E); N. slope of Soğouli

Dag above Çaykara, Davis and Hedge D. 32181 (E); Wilayet Rize: Djimil valley, Blansa 1422 (P, W); distr. İkizdere: Horosdag-Baltas, Davis 20962 (Dodds) (E, K); Wilayet Giresun: Balabandaglari above Tamdere, Davis 20485 (Dodds, Cetik) (E, K); Wilayet Artvin: Zialet Dag between Artvin and Ardahan, Davis and Hedge D. 30290 (E, K). CAUCASUS: Akhty, Becker s.n. (M); Kuban: Tieberda valley, Sommer and Levier s.n. (P). GEORGIA: distr. Ozurgety: Adzarico, Mt. Sakorne, Grossheim 281 (K). TRANSCAUCASIA: Mt. Khivo, Alboff 261 (P). ABKHASIA: near Lechipse, Alboff 39 (P).

This species differs from *G. elegans* M.Bieb. by its perennial habit, linear spatulate basal leaves, purplish anthers, and mountain habitat.

101. *G. iranica* Barkoudah sp. nov.

Plate XIV, Fig. 16–23. p. 138

Herba annua vel biennis?, glaberrima; radice crassa, lutea, perpendiculari; caulibus numerosis, ca. 50 cm altis, omnino dichotomo- et trichotomo-ramosis, teretibus, nodis crassis et internodiis longis, dimidio superiore capillaribus; foliis linearibus, obtusis, 1–2.5 cm longis et 1–2 mm latis; inflorescentia laxa, dichasiali; bracteis triangularibus, scariosis; pedicellis capillaribus, recurvatis, 1–3.5 cm longis; calycibus campanulatis, fere ad medium partitis, laciniis ovatis, acutis vel obtusis, 3.5 mm longis et 2 mm latis; petalis calyce fere duplo longioribus, albis, venis purpureis, ad basim triangularibus, apice emarginatis; staminibus petalis brevioribus; ovario breviter cylindrico, stylis divergentibus, ovulis 20–24; capsula globosa, quadri- valvi, seminibus tuberculatis gibbosis, radícula saliente, 1 mm × 1 mm. Fl. Jul.–Aug.

Type: Iran: Prov. Arak: N. Kuh-i-Chahan below Mishgin Sar, F. Schmid 6529 (W).

Geographic distribution: This species is only known from the type collection.

From its closest relative, *G. elegans*, this species may be distinguished as follows: it has stems that are branched throughout, capillary in the upper part, linear leaves (much narrower than in *G. elegans*), acute to apiculate calyx lobes, 20–24 ovules, and seeds with flat tubercles. *G. muralis* differs by lower stems, smaller leaves, leafy bracts, obtuse calyx lobes, cuneate petals, elongate stigma and smaller seeds.

102. *G. bitlisensis* Barkoudah sp. nov.

Plate XIV, Fig. 24–31. p. 138

Herba annua, glaberrima; caulibus 20–30 cm altis, omnino dichotomo-ramosis, internodiis ca. 5 cm longis; foliis lanceolatis vel oblongis, superioribus linearibus, acutis, 1–2.5 cm longis et 1–5 mm latis; inflorescentia laxa, dichasiali, quinquies ad sexies composita; bracteis late triangularibus, scariosis; pedicellis 1–2.5 cm longis; calycibus campanulatis, fere ad medium partitis, laciniis ovatis obtusis, 2.5–3 mm longis et 2 mm latis; petalis oblongis vel linearibus, retusis vel leviter emarginatis, ad basim angustatis, albis, ca. 1 mm latis, calycem medio superantibus; staminibus petalis brevioribus; ovario brevi cylindrico, stylis divergentibus; ovulis ca. 16; capsula globosa, quadri- valvi; seminibus 1 mm longis, gibbosis radícula saliente, minute tuberculosus. Fl. Jun.–Jul.

In steppes.

Type: Turkey: Wilayet Bitlis: Tatvan-Bitlis, 1800 m alt., Davis 23365 (O.Polunin). Holotype (E), isotype (K).

Geographic distribution: Only known from Wilayet Bitlis in Turkey.

TURKEY: Wilayet Bitlis: Van river, Varah dag, 2000 m alt., A. Kranenberg s.n. (JE).

The following characters serve to distinguish this species from *G. elegans*: the stems are branched throughout, the basal leaves are approximately spatulate, the inflorescence is denser, with rigid pedicels, the calyx lobes are acute, the petals white, more or less cuneate, the seeds bear flat tubercles, and the hilum is not collared. *G. iranica* differs by taller stems with intricate, capillary upper branches, much narrower leaves, apiculate calyx lobes, and 20 ovules.

103. *G. viscosa* Murray, Comm. Goett, 9, t. 3 (1783); DC., Prod. 1: 352 (1824); Boiss., Fl. Or. 1: 551 (1867).

Misapplied name: *G. elegans* auct. non M. B.; Blatter, Fl. Arab: 59 (1919); Post, Fl. Syr. Palest. 1, 2nd. ed.: 166 (1932).

Plate XIV, Fig. 32-39. p. 138

Plant herbaceous, annual, glabrous, glaucous; stem 20-30 cm high, erect, branched in the upper half; upper internodes more or less viscous by sessile glands; basal leaves oblanceolate, upper ones lanceolate, sessile, acute to acuminate; inflorescence loosely dichasial; bracts triangular, scarious; pedicel capillary, 1-1.5 cm long; calyx campanulate, globose, 2 mm long and 2-2.5 mm wide, incised to the middle, lobes ovate, rotundate, scarious-bordered; petals pink to white, oblong, with a shallow contraction between the limb and the claw, retuse to shallowly emarginate, two or three times longer than the calyx; stamens shorter than the petals, spreading; ovary globose, styles short, divergent; ovules 16; capsule, ca. 3 mm long, deeply four-valved; seeds 1 mm  $\times$  1 mm, with obtuse tubercles on the back. Fl. May-Jun.

Sandy valleys, wadi banks, and among weeds in fallow fields, to 1700 m alt.

Type: Cultivated in Hort. Göttingen from seeds collected in Syria, Aleppo. Holotype (Göttingen not seen), isotype (BR).

Geographic distribution: Central and South Turkey, Syria, Palestine, Jordan, Sinai, Northern Saudi Arabia.

TURKEY: Kayseri, Balansa s.n. 1856 (P); Wilayet Sivas: Sivas-Kayseri: near Gemerek, Stainton and Henderson 5114 (E); Wilayet Ankara: Yenizehir, Kotte 126 A. (K); Wilayet Biredik: Hashnadi, Sint 426 (BR, E, JE, K, P); Kurd Dag. Haradjian 1116 (K, W). SYRIA: Aleppo, Aucher 554 (FI, P); *ibid.*, Kotschy 221 (FI) and 149 (K, P); between Aleppo and Hamah, Haradjian 1950 (W); between Dayr Ez-Zawr and Elmayadin, M. Vladimir Besaurd s.n. 1930 (P); Bir Slem near Palmyra, Davis 5793 (E, K); Jabal Druze, Tall Shihan, Dinsmore 3649 (K); Wadi Barada, near Damascus, E. Boissier s.n. 1846 (K, P). JORDAN: Wadi Ram, Davis 10449 (E, K); Arabia Petra, 40 km S. W. of Ma'an, Dinsmore 33748 (HUJ). SINAI: Schimper 332 (L), Mt. Katherina, J. R. Shabetai s.n. (K). SAUDI ARABIA: Fringe of the Great Nafud, Vesey-Fitz Gerald 13532 (HUJ).

This species differs from *G. elegans* M.B. by its viscous upper internodes, sessile lanceolate leaves, pink flowers, rotundate calyx lobes, and seeds without a collared hilum.

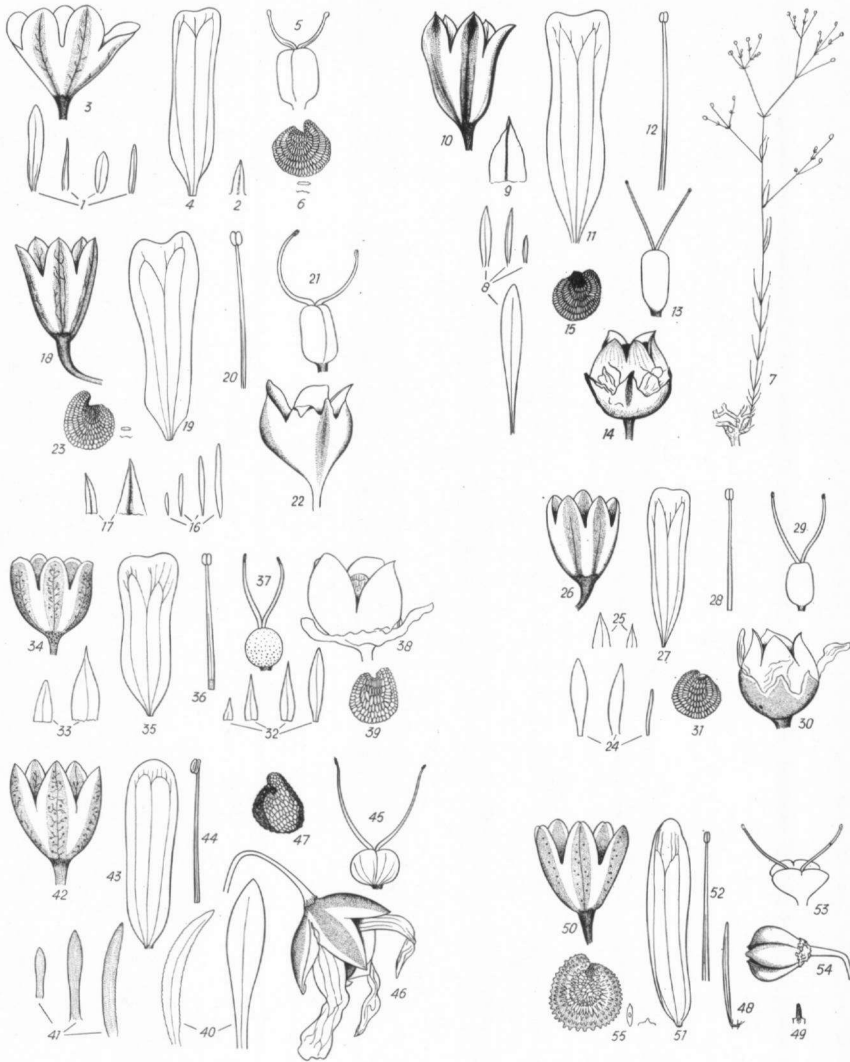


Plate XIV. Fig. 1-6: *G. elegans* var. *elegans*; 1: leaves; 2: bract; 3: calyx; 4: petal; 5: ovary; 6: seed and a tubercle. Fig. 7-15: *G. silenoides*; 7: caudex with one stem; 8: leaves; 9: bract; 10: calyx; 11: petal; 12: stamen; 13: ovary; 14: capsule; 15: seed. Fig. 16-23: *G. iranica*; 16: leaves; 17: bracts; 18: calyx; 19: petal; 20: stamen; 21: ovary; 22: capsule; 23: seed and a tubercle. Fig. 24-31: *G. bitlisensis*; 24: leaves; 25: bracts; 26: calyx; 27: petal; 28: stamen; 29: ovary; 30: capsule; 31: seed. Fig. 32-39: *G. viscosa*; 32: leaves; 33: bracts; 34: calyx; 35: petal; 36: stamen; 37: ovary; 38: capsule; 39: seed. Fig. 40-47: *G. capillaris*; 40: leaves; 41: bracts; 42: calyx; 43: petal; 44: stamen; 45: ovary; 46: capsule; 47: seed. Fig. 48-55: *G. arabica*; 48: leaf; 49: bract; 50: calyx; 51: petal; 52: stamen; 53: ovary; 54: capsule; 55: seed and a tubercle

## Series 2. Deserticolae Barkoudah p. 44

104. *G. capillaris* (Forsk.) Christ., Dansk. Bot. Arkiv. 4, No. 3: 19 (1922).

Basionym: *Rokejeka capillaris* Forsk., Fl. Aegypt. Arab 90 (1775).

Homotypic synonym: *G. rokejeka* Delil., Fl. Egypt. 87, t. 29 (1824); Boiss., Fl. Or. 1: 543 (1867), pro. parte.

Plate XIV, Fig. 40–47. p. 138

Perennial, glaucous, glabrous; stems single or few, 30–50 cm high, branched throughout, branches spreading; basal leaves oblanceolate to linear-oblanceolate, the cauline ones linear, acute, with narrowed base, papillose at the border, 2–6 cm long and 2–15 mm broad; inflorescence lax, dichasial; bracts linear, leafy; pedicel capillary, 1–1.5 cm long, mostly recurved; calyx wide-campanulate, 2.5–3 mm long and as wide, parted to the middle, with ovate, obtuse lobes, green bands as broad as the scarious intervals; petals linear-oblong, one and a half to two times as long as the calyx, rotundate, narrowed at the base, white with purple veins; stamens shorter than the petals, spreading; ovary globose, styles long, divergent, ovules 12; capsule globose, surrounded by the dry calyx, as long as the calyx, deeply four-valved, with 4–6 seeds; seeds 1 mm  $\times$  0.8 mm, with flat tubercles. Fl. April–May.

On desertic sandy soil.

Type: Egypt: near Cairo, Forskal s.n. 1762 (C not seen).

Geographic distribution: N. Egypt, between the Nile and the Suez Canal; Sinai.

EGYPT: Gabal Akma near Cairo, C. G. Ehrenberg s.n. (BR, K, P); Wadi abu Silly, near Helwan, Davis 10498 (E, K). SINAI: Nakab, Schimper 435 (F1).

105. *G. arabica* Barkoudah sp. nov.

Misapplied names: *G. rokejeka* auct. non Del.; Post, Fl. Syr. Pal. ed. 2, 1: 165 (1932); Blakelock, Kew Bull. 399 (1948); *G. capillaris* auct. non Christ.; Blakelock, Kew Bull. 2: 193 (1957).

Plate XIV, Fig. 48–55. p. 138

Perennis, glaberrima; caulibus teretibus, ramis capillaribus, ad basim ramosissimis, glaucescentibus, 50–60 cm altis, nodis crassis; foliis linearibus, glaucescentibus, caducis, apice obtusis, basi angustatis haud connatis, 1–2.5 cm longis et 1 mm latis; inflorescentia laxa, dichasiali, floribus numerosis; pedicellis ad 2.5 cm longis; bracteis perparvis, foliaceis; calycibus campanulatis, 2.5 mm longis, ad medium partitis, laciniis ovatis, obtusis vel emarginatis, margine scariosis; petalis albis, venis pupureis vel albis, calyce medio brevioribus; ovario obovoideo, quadrilobato, apice depresso, stylis petalis brevioribus, ovulis quattuor, placenta brevissima; capsula globosa, quadrivalvi, valvis haud divergentibus; seminibus globosis duobus, 1 mm longis, gibbosis, radícula saliente, echinato-tuberculatis. Fl. the whole year, mainly in spring and early summer (reported from Palestine).

In collinis aridis et agris incultis.

Type: Palestine: near Jerusalem, Roth s.n. 1860. Holotype (M), isotype (L).

Geographic distribution: S. Turkey, Syria, E. Iraq, Palestine, and N. Saudi Arabia.

**TURKEY:** Wilayet Urfa: Akçakale, Davis and Hedger D. 28110 (E, K). **IRAQ:** Jabal Hamrin, Southerland 183 (W); Mesopotamia, Aucher-Eloy 551 (FI); Ghurfa plain, Guest 4003 (K); *ibid.*, near Injana Guest 4003 (K); Baba Gurgur, Guest 4013 bis (K). **SYRIA:** On the way from Damascus to Palmyra, Kotschy 249 (BM, P); An Nabk, Davis 6479 A. and 6469 A. (E, K); in Coelesyria, Blanche 2927 (L); around Damascus, Gaillardot s.n. 1853 (JE); Jabal Druze, Jabal Kulayb, Dinsmore 10136 (K). **PALESTINE:** Mt. Gilboa above Steftoi Bah, Davis 4687 (E, K); Masada near the Dead Sea, Dinsmore 6126 (E); Jerusalem Siluam, Meyers 124 (E); Jerusalem-Ariha, Davis 3707 (E, K). **SINAI:** Bovén 539 (P). **SAUDI ARABIA:** Jabal Salma, Nejd, Vessey-Fitz Gerald 13544 (HUJ); Central Midian, Burton (K); Hijaz, Bani Khatam, W. Thesiger s.n. 1946 (BM).

This species differs from the closely related *G. capillaris* (Forsk.) Christ. by its linear leaves, shorter internodes (3–4 cm), smaller branching angle (ca. 60°), non-papillose leaves, rotundate to emarginate calyx lobes, four-lobed ovary, only 4 ovules, mostly bare capsule, only two, acutely tuberculate seeds, and its habitat.

106. *G. antari* Post et Beauverd in Dinsm., Pl. Post. and Dinsm. fasc. 1: 4 (1932); Fedde Repert. 33: 103 (1933).

Plate XV, Fig. 1–8. p. 143

Annual, rarely biennial herb with perpendicular whitish root, with one stem appearing in the first year and a few in the second year, 5–40 cm high, branched throughout, glaucous, glabrous; basal leaves spatulate, subpetiolate, the upper ones linear, acuminate, 2–5 cm long and 3–6 mm broad; inflorescence lax, dichasial; bracts linear, leafy; pedicel capillary, to 2.5 cm long; calyx campanulate-turbinate, 2.5 mm long and 1.5 mm wide, incised to the middle; lobes ovate, obtuse to rotundate; green bands as broad as the scarious intervals; petals cuneate, about one and a half times as long as the calyx, rotundate, white with purple veins; stamens shorter than the petals; ovary globose; styles divergent, short; ovules 16; capsule globose, as long as the calyx; seeds 1 mm × 1 mm, with flat tubercles. Fl. April–May.

On stony and sandy soil.

Type: Syria: The Desert, near Marbat Antar, Post 3615 a. Holotype (BEI not seen), isotype (K)!

Geographic distribution: Syrian Desert, E. and S. Iraq, Kuwait, and N. Saudi Arabia.

**IRAQ:** Jabal Hamrin, Gillett and Rawi 7323 (K); Baghdad, Faluja desert, Haines W. 167 (K); Ad-Diwaniyah, Wadi Khirr 9 km N.N.W. of Shabicha, Rechinger 9483 (W); S. desert: Al-Basrah: Shaib al-Batin near Safai al Maghif (N.E. Ghazlani), 100 km W.S.W. of Basrah, Rechinger 8823 (W). **KUWAIT:** Asapjan, Dickson 111 (K). **SAUDI ARABIA:** Madraka, N.E. of Jedda, Trott 193 (K); Central Arabia, H. St. Philby s.n. 1935 (BM).

This species differs from *G. capillaris* (Forsk.) Christ. by being annual or rarely biennial, by having a smaller branching angle (ca. 30°), acuminate leaves, 16 ovules, and cuneate petals.

107. *G. obconica* Barkoudah sp. nov.

Plate XV, Fig. 9–16. p. 143

Herba annua, caulibus ca. 30 cm altis, albis, rigidis, glaberrimis,



ad basim ramosis, dichotomis vel trichotomis, internodiis 3–4 cm longis, superioribus capillaribus; foliis lanceolatis, acuminatis, ad basim angustatis, superioribus linearibus, fere carnosis; inflorescentia laxa, dichasiali; bracteis linearibus foliaceis; pedicellis capillaribus, 1.5–2.5 cm longis; calycibus campanulatis, ad medium partitis, laciniis ovatis, obtusis, 2.5 mm longis; petalis oblongo-cuneatis, calycem medio superantibus, albis, nervis purpureis; staminibus petalis aequilongis; ovario globoso, stylis petalis longioribus; ovulis quattuor; capsula globosa, indehiscente, 2 mm longis; seminibus tribus, tuberculato-echinatis, gibbosis, radícula saliente, 1.2 mm longis.

Type: Iran; Prov. Ahvaz; Bandar-e-Deylam, C. Haussknecht s.n. 1868. Holotype (P), isotype (BM, K).

Geographic distribution: W. Iran and N. E. Iraq.

IRAN: Between Baghdad and Kermanshah, Olivier and Bruguère s.n. (P); between Seytun and Bebehan, Haussknecht s.n. 1868 (BM, JE, K, P). IRAQ: Mosul region: Irbil, between Irbil and Altun Kupri, Haussknecht s.n. 1867 (JE); Qaiyarah, Bayliss 123 (K); Kor Moc, 30 miles from Tuz, Rogers H. 2333 N. of Adhaim? Robertson R.B. 25 (K); 8 km east of Kirkuk, Gillett and Rawi, 11597 (K); 2 km north of Kirkuk, Rawi 1554 (K); Mesopotamia, Aucher 551 (K).

This species differs from *G. antari* Post by its rigid stem, its acuminate leaves, its globose ovary, its 4 ovules, its indehiscent capsule with only three acutely tuberculate seeds. *G. aobconica* inhabits dry hills, not sandy deserts.

Subsection. C. Longipetalae Barkoudah p. 44

108. *G. xanthochlora* Rechinger f., Bot. Jahrb. B. 75: 355 (1952) (as xantheochlora).

Plate XV, Fig. 17–24. p. 143

Perennial; stem erect, branched in the upper two-thirds, yellowish green, mostly with viscous internodes, 60–70 cm high; basal leaves spatulate, rotundate, cauline ones linear-lanceolate, acute, narrowed at the base; inflorescence very many-flowered, lax, dichasial, with thin glabrous branchlets; bracts triangular, scarious; pedicel capillary, to 2.5 cm long; calyx campanulate, 2 mm long and 2 mm wide, incised nearly to the middle; lobes ovate, acute; green bands half as broad as the scarious intervals; petals cuneate, rotundate, narrowed at the base, with a shallow contraction between the limb and the claw, nearly twice as long as the calyx; stamens unequal, the long ones as long as the petals; ovary globose; styles divergent, short, ovules 8; capsule globose, hardly longer than the calyx, bare, deeply four-valved; seeds 2 mm × 1.5 mm with acute tubercles. Fl. Jun.–Jul.

In crevices of calcareous rocks and on dry slopes, 1000–1500 m alt.

Type: Iran: Prov. Shahrud-Bastan, Mt. Sahvar near Nekarman (Nigerman), Rechinger 5836. Holotype (W), isotype (K).

Geographic distribution: N. Iran.

IRAN: Karimserai, Mazanderan, Koelz 16505 (W).

109. *G. persica* Barkoudah sp. nov.

Plate XV, Fig. 25–31. p. 143

Perennis; radice ca. 1 cm crassa, perpendiculari; caulibus pluribus,

(3-4), erectis, ca. 30-40 cm altis et 4 mm crassis, dimidio superiore ramosis et glanduloso-pubescentibus; foliis linearibus vel spatulatis, acutis, basi subdilatatis et connatis, caulinis linearibus, 2-6 cm longis et 2-20 mm latis; inflorescentia laxa, dichasialis; pedicellis 1-2 cm longis, capillaribus; bracteis ovatis, acuminatis, scariosis; calycibus late campanulatis, 2 mm longis et 2 mm latis, ad medium partitis, laciniis ovatis, apiculatis vel acutis, margine late scariosis; petalis oblanceolatis, rotundatis, ad basim angustatis, leviter contractis, calyce fere duplo longioribus; staminibus inclusis, minutis, ut videtur, subabortivis, inaequilibus, episepalis longioribus; ovario globoso, stylis divergentibus, petalis aequilongibus, ovulis 12. Fl. Jun.-Jul.

On subdesertic dry hills and mountain slopes, up to 2200 m alt.

Type: Iran: Qazvin, Hjalmar Pravitz 913 (W).

Geographic distribution: N. W. Iran and E. Iraq.

IRAN: Elburz: Cheheristanek valley, Mt. Totchal, Bornmüller 6334 (P); Arāk: Mt. Kuh-e-Tafresh, Th. Strauss s.n. 1897 (JE); IRAQ: As-Sulaymaniyah: Kopi Qara Dagħ, Poore 446 (K); *ibid.*, Gillett 7932 (K).

This species shows some similarity to *G. xanthochlora* Rechinger. The spatulate leaves, the small, widely campanulate calyx, the oblanceolate rotundate petals, and the globose ovary are very similar in both species. *G. persica* differs by its linear cauline leaves, its glandular-hairy, not viscous stem, its apiculate calyx lobes, its longer petals, its shorter stamens, its longer styles and its 12 ovules. On the other hand, *G. persica* resembles *G. polyclada* Fenzl. The narrowly linear cauline leaves, the apiculate calyx lobes, the smaller calyx, the shorter stamens, and the 12 ovules serve to distinguish these two species.

110. *G. polyclada* Fenzl ex Boiss., Fl. Or. 1: 542 (1867); Parsa, Fl. de l'Iran 1 (2): 1023 (1951).

Heterotypic synonym: *G. koeii* Rechinger f., Dansk Bot. Arkiv 15, 4 (1955) 20.

Type: Iran: Luristan, Bicheh, Køie 685 (Kopenhagen, W).

Plate XV, Fig. 32-39. p. 143

Perennial; root woody, brown; stems single or few, erect, branched nearly throughout, glabrous below, glandular-hairy above, especially above the nodes, and more or less viscous, 20-70 cm high; basal leaves spatulate, obtuse to rotundate, 2-7 cm long and 1-2.5 cm broad, mostly with three or more nerves, the cauline ones lanceolate, acute to acuminate, 2-3 cm long and 5-10 mm broad, glaucous; inflorescence loosely dichasial; bracts triangular, acuminate, scariosus; pedicel capillary, 1-2.5 cm long; calyx campanulate, 2.5-3 mm long, incised to the middle; lobes ovate, acute to obtuse; green bands narrower than the scariosus intervals; petals oblanceolate, one and a half to two times as long as the calyx, rotundate, narrowed at base, with a shallow contraction between the limb and the claw; stamens shorter than the petals, spreading; ovary ovoid, styles long, incurved; ovules about 8; capsule globose, ca. 3 mm long; seeds 2 mm × 1.5 mm with coarse obtuse tubercles. Fl. Jun.-Jul.

On stony calcareous slopes and in fallow fields.

a. Var. *polyclada*: Inflorescence glandular-hairy only above the

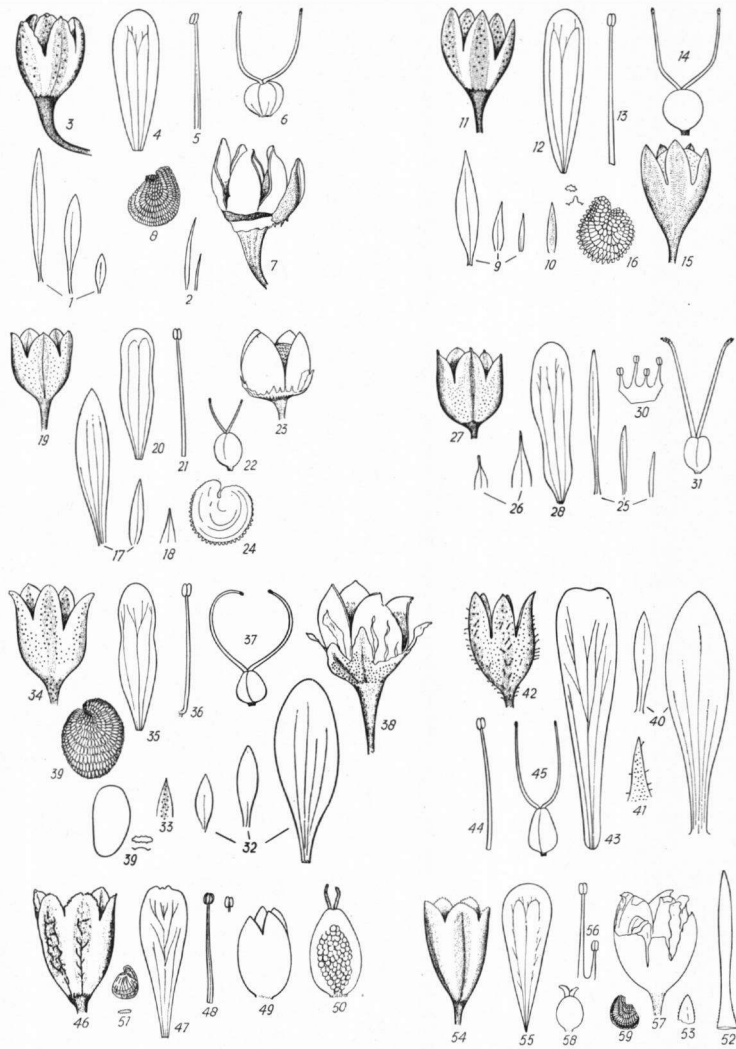


Plate XV. Fig. 1-8: *G. antari*; 1: leaves; 2: bracts; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: seed. Fig. 9-16: *G. obconica*; 9: leaves; 10: bract; 11: calyx; 12: petal; 13: stamen; 14: ovary; 15: capsule; 16: seed and tubercles. Fig. 17-24: *G. xanthochlora*; 17: leaves; 18: bract; 19: calyx; 20: petal; 21: stamen; 22: ovary; 23: capsule; 24: seed. Fig. 25-31: *G. persica*; 25: leaves; 26: bracts; 27: calyx; 28: petal; 29: stamens; 30: ovary; 31: ovary. Fig. 32-39: *G. polyclada* var. *polyclada*; 32: leaves; 33: bract; 34: calyx; 35: petal; 36: stamen; 37: ovary; 38: capsule; 39: seed, a cross-section of it and a tubercle. Fig. 40-45: *G. lurorum*; 40: leaves; 41: bract; 42: calyx; 43: petal; 44: stamen; 45: ovary. Fig. 46-51: *G. muralis* var. *muralis*; 46: calyx; 47: petal; 48: stamen; 49: capsule; 50: ovary; 51: seed and a tubercle. Fig. 52-59: *G. macedonica*; 52: leaf; 53: bract; 54: calyx; 55: petal; 56: stamens; 57: capsule; 58: ovary; 59: seed

nodes, pedicel glabrous; calyx campanulate, lobes acute to obtuse; petals oblanceolate.

Type: Iran: S. of Khakan: Mt. Kuhdena, Kotschy 674. Holotype (W), isotypes (BM, K, L).

Geographic distribution: Iran: more abundant in the E. and N.; E. Iraq.

IRAQ: Solaimaniya: Penjwin, Rawi 22614 (K), Mela Kowa, on Solaimaniya-Penjwin highway, Rawi 22438 (K), Meshula, Mergdreiya near Haji Omran, Rawi 9130 (K), Kopi Qaradagh, Wheeler Haines W 1101 (K), Assyrian desert, Aucher 548 (FI, K, P). IRAN: Elburz: Shahrstonek, Kotschy 552 (BM, FI); Hamadan, Pichler s.n. 1882 (E); Isfahan, Aucher-Eloy 4264 (BM, FI, K, P); Mt. Owrāmān, Haussknecht 131 (JE); Qazvin, Bornmüller 6335 (BM, E); between Kermanshah and Hamadan, Olivier and Bruguière (P).

b. *Var. glandulosa* Barkoudah var. nov.

Inflorescentia glanduloso-pubescentibus; calyx late campanulatus, laciniis oblongis, emarginatis, petalis linearibus, leviter emarginatis, calyce duplo longioribus.

Type: Iran: Luristan: Durud, Koelz 15836 (W).

IRAN: Arāk: Mowdere, Strauss s.n. 1890 (JE), at the foot of Shahsind, Strauss 422 (JE); *ibid.*, Strauss s.n. 14 VI 1904 (JE).

111. *G. lurorum* Rechinger f., Bot. Jahrb. B. 75: 354 (1952).

Plate XV, Fig. 40–45. p. 143

Perennial, stems 60–80 cm high, erect, branched trichotomously nearly throughout, lower branches short, upper ones nearly as long as the main axis, glandular-hairy, viscid throughout, yellowish green; leaves spatulate, semipetiolate, acute, slightly connate at the base, lower ones glabrous, upper ones glandular-hairy on the lower surface, obscurely 3–5-nervate; inflorescence with very many flowers, lax, dichasial; bracts lanceolate, scarious-bordered, glandular-hairy on the lower surface; pedicel to 2.5 cm long, capillary, glandular-hairy; calyx campanulate, 3 mm long and 2 mm broad, incised to the middle; lobes ovate, mucronulate, green bands as broad as the scarious intervals; petals twice or to three times as long as the calyx, linear to spatulate, emarginate to shallowly bilobed; stamens longer than the calyx, spreading; ovary ovoid; styles divergent, long, ovules 8. Fl. May–June.

Type: Iran: Luristan: Chamchid, W. Koelz 15842. Holotype (W).

Geographic distribution: Only known from W. Iran, Iraq?

IRAN: Bicheh, Kōie 730' (W); Luristan: Durud, Koelz 15616 (W). IRAQ: Sulaimaniya: Kopi Qaradagh, Wheeler Haines W. 1104 (K). This specimen bears only fruits and the determination is not entirely certain; it may also represent an undescribed, related species.

II. Subgenus *Macrorrhizaea* (Boiss.) Pax et Hoffmann p. 45

112. *G. muralis* L.

*Gypsophyllus minimus muralis* C. Bauh., Pin. 211 (1623); *Lychnis parva palustris, foliis acutis lanceolatis, flosculis purpureis* Mentzel, Pugillus t. 7, f. 4, (1682); *Saponaria calycibus pentaphyllis, corollis*

*crenato — emarginatis, foliis subulatis planis* L., Fl. Suec. 127, n. 347 (1745); *Gypsophila foliis linearibus planis, caulo dichotomo...* etc. L., Nova Gen. Pl. (Prop. Chenon) 42 (1751). *Gypsophila muralis* L., Sp. Pl. 1: 408 (1753). DC., Prod. 1: 354 (1824); Halácsy, Consp. Fl. Graec. 192 (1900); Ledeb., Fl. Ross. 1: 288 (1824); Hegi, Fl. Mitt.-Europ. 3: 310 (1935).

Homotypic synonyms: *Dichoglottis muralis* (L.) Jaub. et Sp., Illustr. 1: 13 (1842); *Saponaria muralis* (L.) Lamarck, Fl. Fr. 2: 540 (1778).

Heterotypic synonyms: *G. muralis* L. form. *montis apium* O. Kuntze, Taschenl. 229 (1867). Type: no material is cited. *G. muralis* L. var. *parviflora* Lomotte, Prod. Fl. Centr. France 1: 133 (1877). Type: Lomotte from Central France (not seen). *G. muralis* L. form. *capillaris* Fiek u. Schube, Jahrb. Schles. Ges. vaterl. Kult. Bresl. Bot. Sect. 71: 46 (1893). Type: Poland, Görlitz, Barber (not seen). *G. muralis* L. form *micropetala* Holmberg, Bot. Notiser 71 (1900). Type: Sweden, Skåne, Gladsax near Horsehall, Holmberg s.n. (LD)! *G. muralis* L. var. *stenopetala* Zapalowicz, Consp. Fl. Gal. 3: 99 (1906). Type: W. Marmara, Borsabanin, Zapalowicz (not seen). *G. agrestis* Pers., Syn. 1: 492 (1805). Type: No type or any other material is cited, only Lamarck, Illustr. t. 375 f. 1 (1791)! *G. serotina* Hayne ex Willd., Enum. Pl. 464 (1809). Type: Germany, fields near Magdeburg (not seen). *G. purpurea* Gilib., Fl. Lithuan. 2: 154 (1781). Type: Gilibert from Lithuania (not seen).

Plate XV, Fig. 46–51. p. 143

Annual herb; stem 5–20 cm high, branched throughout, puberulent below, glabrous above, capillary; leaves linear, 1–2.5 cm long and 1–3 mm broad, acute to obtuse, angustate at the base; inflorescence lax, dichasial; bracts leafy, pedicel capillary, many times longer than the calyx; calyx long-campanulate, 2.5–4 mm long and 0.5–2.5 mm wide, incised to  $\frac{1}{4}$ th or  $\frac{1}{3}$ rd, with rotundate or erose teeth; petals one and a half to two times as long as the calyx, cuneate, pink or white, with darker veins, rotundate or erose at the apex; stamens as long as or longer than the calyx; ovary ovoid; styles divergent, short; stigmatic surface along the whole inner side of the styles; ovules 20–36; capsule oblongoid, longer than the calyx, seeds small, numerous, 0.5 mm  $\times$  0.5 mm, with flat tubercles. Fl. May–Jul.

In fields, on abandoned arable land, along roads, meadows, and on walls.

a. **Var. muralis:** Leaves 1–2.5 mm broad, calyx 3–4 mm long, petals pink, capsule slightly longer than the calyx.

Type: Linnaeus described this species from living material in Sweden. *G. muralis* L. n. 579 18 (LINN) is an authentic specimen.

Geographic distribution: Europe: from South Sweden and South Finland in the North to North Spain, North Italy, and the Caucasus in the South, but less abundant in Western Europe. U.S.S.R. (Siberia except the arctic part: Ob, Upper Tobol, Irtysh, Altai, Angaria-Sayan to Baikal Sea; Far East: Ussuri region).

SWEDEN: Skåne, Ivö, Ivö, Hasslow 795 (L, P, W). BELGIUM: Rochefort, Prov. Namur, Crépin 304 (BR). LUXEMBURG: Verheggen (BR). POLAND: N. of Skawina near Krakov, Kornas, Kostrakiewicz and Tacik 411 (L). GERMANY: Hamburg, Kuhwerder, C. Kausch s.n. 1918 (L); Heidelberg, Wirtgen s.n. 1834 (L). FRANCE: Jurat in fields, Leresche s.n. (L). SPAIN: Cerdana, Caldegas, Sennen 2986 (BR); Aragón, Jusèu, Fraucavillan s.n. 1843 (BR). GREAT RUSSIA: near Pultava, Leresche s.n. (L). AUSTRIA: along the river March, Baumgarten s.n. (W). SWITZERLAND: Föhrenreg, Tavanasa, Hager s.n. 1917 (W). HUNGARY: Lang s.n. (L). ITALY: Cumiana, on the river Clenitta, Zola 17047 (FI). ROMANIA: Transsylvania, Schwer s.n. (L). TURKEY: Marmara: in fields, Wagner s.n. (L). ALTAI (U.S.S.R.): Ledebour s.n. (BR).

b. Var. *stepposa* (Klok.) Šiškin, Fl. Jugo-Vost. (Fl. of the South-East) 4: 300 (1930). Basionym: *Gypsophila stepposa* Klokov, Jour. Soc. Bot. de Russie 6: 137 (1921); Not. Syst. Herb. Hort. Petrop. 4: 95 (1923); Šiškin in Komar., Fl. U.S.S.R. 6: 774 (1936).

Leaves narrower than in the type var., ca. 0.5 mm broad; flowers smaller, white; capsule as long as the calyx.

Type: Ukraine (U.S.S.R.): Prov. Charkov, distr. Kupjansk, near Kislovka, Klokov (CW, LE not seen).

Šiškin (1936) gives the following geographic area: U.S.S.R. (Black Sea region, Volga — Don, Lower Don, Syr-Darya, Balkash Sea region).

KAZAKH S.S.R.: Prov. Syr-Darya, distr. Aulie-Ata, near Kirgizski Khurebet Mt., near Merke, Mokeeva and Popov 125 (BR, P). URALSK: Bureau s.n. 1875 (P). DZUNGARIA: Schrenk s.n. (P). TURGAY: Semipalatinsk, Karelin and Kirilov 631 (BR, P, W). TURKEY: Lazistan, Aucher-Eloy 568 (P).

113. *G. macedonica* Vandás, Magyar. Bot. Lap. 4: 111 (1905).  
Plate XV, Fig. 52–59. p. 143

Perennial; root woody; stems many, caespitose, 10–15 cm high, glabrous, slender, branched in the upper part; inflorescence paniculate-dichasial; leaves linear, acute, rigid, 2–6 mm long and about 0.5 mm broad, flat, ciliate at the base; pedicel capillary, 4–8 mm long; calyx campanulate-turbinate, 2.5–3 mm long and 1.5 mm wide, teeth small, semi-circular, ciliate, green bands broader than the intervals; petals cuneate, pink, one and a half times as long as the calyx, rotundate; stamens shorter than the petals, sometimes unequal; ovary ovoid; styles very short, stigmatose along their inner side, ovules ca. 30; capsule slightly longer than the calyx, globose, deeply four-valved, with numerous seeds; seeds 0.5 mm × 0.5 mm, with small flat tubercles. Flowering season not noted.

Type: S. Yugoslavia: Bitola, Formánek s.n. (KRAM).

This species is only known from the type collection.

*G. macedonica* Vandás resembles most closely *G. muralis* L. The general habit, inflorescence, flowers, and fruits are quite comparable. Yet, *G. macedonia* can be distinguished easily by its perennial habit, completely glabrous stem, rigid acute leaves, shorter pedicel, ciliate bracts and calyx lobes. *G. macedonia* also shows some similarity to *G. spergulifolia* Griseb. For the differences see the illustrations.

114. *G. tubulosa* (Jaub. et Sp.) Boissier, Diagn. ser. 1 (I): 11 (1842); Fl. Or. 1: 554 (1867).

Basionym: *Dichoglottis tubulosa* Jaub. et Spach, Illustr. Pl. Or. 1: 13, t. 6 (1842-43).

Plate XVI, Fig. 1-10. p. 149

Annual; stem 7-20 cm high, branched throughout, glandular-pubescent, glaucous; leaves linear, subaciculate, 1-1.5 cm long and less than 1 mm broad, acute; inflorescence dichasial; pedicel 1-2.5 cm long, puberulent; bracts leafy; calyx tubiform, 5-7 mm long and 1-1.5 mm broad, puberulent with longer glandular hairs, incised to one-fifth, teeth semi-circular, ciliate; petals linear-cuneate, one and a half times as long as the calyx, bilobed to emarginate, pink with darker veins; stamens shorter than the petals, mostly unequal; androphore short; ovary narrowly ovoid, styles long, parallel, stigmatose on their whole inner side; ovules ca. 32; placenta long; capsule narrowly ovoid, shorter than the calyx, with numerous seeds; seeds 0.5 mm  $\times$  0.5 mm, with small flat tubercles. Fl. Jun., fr. Jul.

On stony slopes and on schist.

Type: Wilayet Izmir: Mender valley, Jaubert (not seen), topotype, Boissier s.n. (JE, K, P).

Geographic distribution: W. Turkey, rare in Greece.

TURKEY: Wilayet Usak: Kaia-gueul-Keni, Balansa 1293 (K, L), 223 (BM, BR, JE, K, P); Demirci, S. of Simav, Uvarov 51 (BM); Wilayet Aydin: Denizli, St. Lager s.n. 1905 (M, W); Denizli, Baba Dag, Davis 18374 (E); Mt. Gume Dag above Tire, Bornmüller 9124 (BM, E, FI, JE, M); Wilayet Izmir: Mt. Orti, Sint s.n. (M); Ak Dag, W. of Tmolus, Balansa 109 (BM, JE, K, P, W). GREECE: Thessaly: Karia, C. Pinard s.n. 1843 (FI, K).

This species is closely related to *G. muralis* L. It can be readily distinguished by its glandular-hairy indument, its long tubiform calyx and its linear, cuneate, emarginate or bilobed petals. The narrowly ovoid ovary and the entirely stigmatose styles are characters typical for *Bolanthus* and *Saponaria* rather than for *Gypsophila*; moreover, *G. tubulosa* shares the presence of an androphore and a long placenta with *Saponaria* and its leafy bracts and tubiform, strongly costate calyx with *Bolanthus*. Its inclusion in *Gypsophila* seems nevertheless justified. It has many characters in common with *Gypsophila muralis*; on the other hand, many other characters typical for *Saponaria* (calyx without hyaline intervals; petals with a corona, clearly divided into a claw and a limb, claw winged; seeds globose; radicle not prominent and for *Bolanthus* (inflorescence contracted, petals clearly divided into a claw and a limb; seeds comma-shaped, radicle long prominent) are absent

115. *G. australis* (Schlecht.) A. Gray, Bot. United States Expl. Exped. 1: 112 (1855).

Basionym: *Dichoglottis australis* Schlecht., Linnaea 20: 631 (1847).

Misapplied names: *Saponaria tubulosa* (Jaub. and Sp.), F. Muell., Indig. Pl. Vict. 1: 136 (1860-65); *G. tubulosa* auct. div. Fl. New Zealand non Boiss.; Hooker, Fl. New Zealand 22, 725 (1867).

Plate XVI, Fig. 11-18. p. 149

Very similar to the preceding species; stem 10-30 cm high, puberulent, with scattered longer hairs; leaves 1-2.5 cm long and about 0.5 mm broad; inflorescence often with solitary flowers in the lower leaf-axils, otherwise dichasial; calyx mostly 4.5-5 mm long; ovules ca. 40, seeds 0.7 mm  $\times$  0.5 mm.

On sandy soil.

Type: Australia: Victoria: Bethania, Schlechtendal s.n. (HAL).  
 Geographic distribution: New Zealand and Southern Australia.

NEW ZEALAND: Wellington, N. Island and Haumer on S. Island, Travers s.n. 1909 (L); Otago, Hector and Buchanan 13678 (P); S. Island: Jakapo Lake, Canterbury Alps, J.J.L.? s.n. in Herb. Cheeseman (FI); Canterbury, J. Haast s.n. 1866 (BR); without exact loc. Hooker s.n. (K, P). AUSTRALIA: N. S. Wales, Brown 6201 (BM, E); Jackson, Brown 62 (E); W. Australia, Drummond 93 (P); N. S. Wales, U.S. Pacific Exped. s.n. 1838-42 (A. Gray collect. in G H); Port Jackson, D. D'Urville s.n. (P).

This species is geographically far isolated from other *Gypsophila* species.

116. *G. confertifolia* Huber-Morath, Fedd. Repert. 52: 42 (1943).  
 Plate XVI, Fig. 19-25. p. 149

Annual, glaucous, glandular-hirsute; stem 2-5 cm high, branched throughout, with short internodes (ca. 1 cm), every branch ending in a small flower-head; leaves linear, trinervate, acute to obtuse, glandular-hirsute, 1-1.5 cm long and about 1 mm broad; inflorescence dense, dichasial; flower capitulum with ca. 9 flowers; bracts leafy, shorter than the calyx; calyx tubiform, ca. 7 mm long and 1.5 mm wide, glandular-hirsute, incised to one-third, with deltoid obtuse lobes, green bands broader than the scarious intervals; pedicel to 2 mm long, mostly wanting; petals linear-cuneate, ca. 8.5 mm long and 1.5 mm broad, pink, bilobed, spreading; stamens shorter than the calyx, unequal; androphore 1 mm long; ovary obovoid; styles incurved; stigmatic surface over the extreme inner part of the styles; ovules 12-14; capsule shorter than the calyx; seeds 1 mm × 1 mm, with flat tubercles. Fl. Jun.

In *Pinus brutia* forests with maquis vegetation of *Cistus creticus*, *Myrtus communis*, and *Erica arborea*.

Type: Turkey: Wilayet Mugla: between Mugla and Fethiya along the coast, 141 km from Mugla, Jenny Reese s.n. 7 VI 1938 (B destroyed). Neotype: Wilayet Burdur: 5 km S. of Dirmil, Huber-Morath 8042 (E), isotype (K).

This species is similar to *G. tubulosa* and *G. muralis*. It may be distinguished by its low stem, dense inflorescence, trinervate leaves, very short pedicel, and terminal stigmatic surface.

### III. Subgenus *Pseudosaponaria* Williams p. 45

#### Series 1. *Hispidae* Šiškin p. 46

117. *G. hispida* Boissier, Diagn. ser. 1, (I): 11 (1842); Fl. Or. 1: 552 (1867).

Heterotypic synonyms: *Gypsophila ixodes* Haussknecht ex Bornmüller, Beih. Bot. Centralbl. 28 (II): 137 (1911). Type: Turkey Wilayet Elaziğ, Hassanova near Nerskiep, Sint 2992 (P)!; *G. xanthina* Bornmüller et Woron., Monit. du Jard. Bot. de Tiflis, livre 32: 1 (1914). Type: Transcaucasia (Turkey): Kars, Woronow 12307 (LE)!  
 Plate XVI, Fig. 26-31. p. 149

Perennial, glaucous; stems several, glabrous below, glandular-hispid above, 3 mm thick, 20-40 cm high, whitish, branched only in the



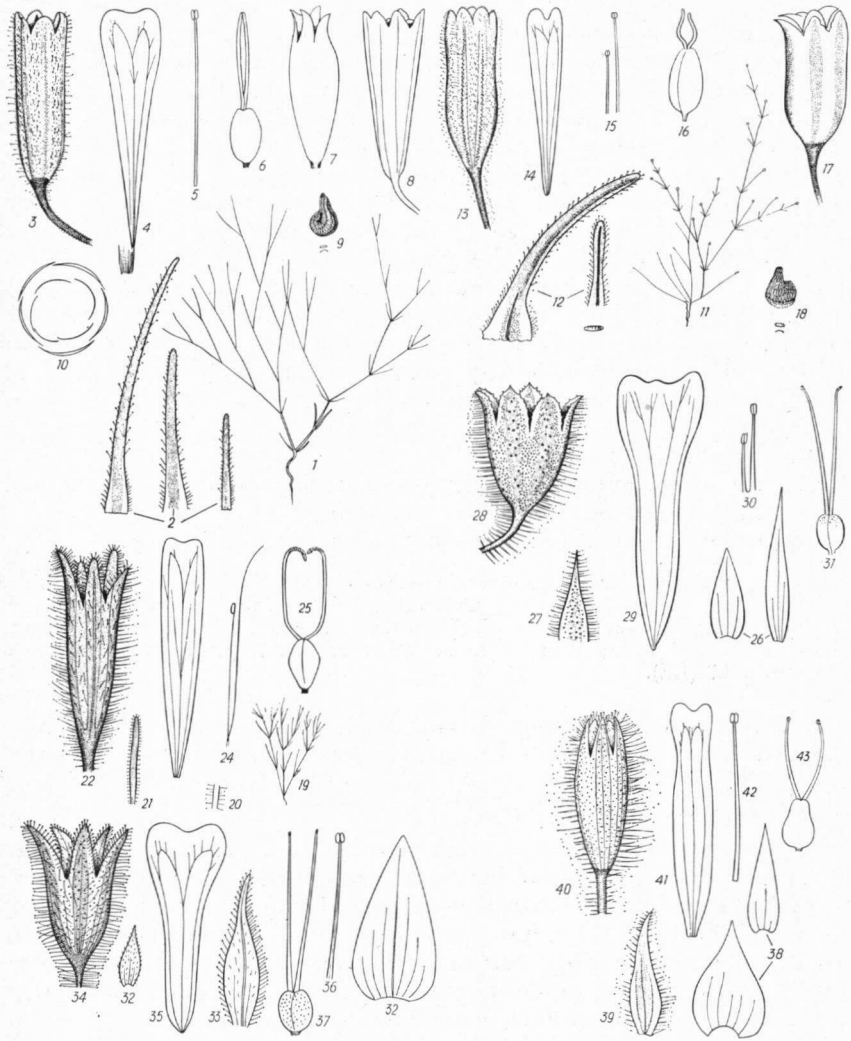


Plate XVI. Fig. 1-10: *G. tubulosa*; 1: a whole plant; 2: leaves; 3: calyx; 4: petal; 5: stamen; 6: ovary; 7: capsule; 8: fruit; 9: seed and tubercle; 10: flower diagram. Fig. 11-18: *G. australis*; 11: a whole plant; 12: two leaves and a cross-section of one of them; 13: calyx; 14: petal; 15: stamens; 16: ovary; 17: capsule; 18: seed and tubercle. Fig. 19-25: *G. confertifolia*; 19: a whole plant; 20: a piece of a stem; 21: leaf; 22: calyx; 23: petal; 24: petal and a stamen; 25: ovary. Fig. 26-31: *G. hispida*; 26: leaves; 27: bract; 28: calyx; 29: petal; 30: stamens; 31: ovary. Fig. 32-37: *G. fedtschenkoana*; 32: leaves; 33: bract; 34: calyx; 35: petal; 36: stamen; 37: ovary. Fig. 38-43: *G. villosa*; 38: leaves; 39: bract; 40: calyx; 41: petal; 42: stamen; 43: ovary

upper part, internodes ca. 2 cm long; lower leaves oblong-lanceolate, 3–7 cm long and 7–15 mm broad, mostly trinervate, acuminate, the upper ones smaller, lanceolate to linear-lanceolate, whitish-glaucous, inflorescence glabrous, trichotomous below, dichasial above, 3–4 times compound, glandular-hispid; bracts lanceolate, acuminate, glandular-hispid; pedicel capillary, patent, to 2 cm long, mostly 1 cm, densely glandular-hispid; calyx campanulate-tubiform, 4–6 mm long and 3–3.5 mm wide, glandular-hispid, cleft nearly to the middle, lobes ovate, obtuse or apiculate scarious on the border, green bands as broad as the scarious intervals, everywhere with many dense calciumoxalate crystals in the parenchyma; petals oblong, with a shallow contraction between the limb and the claw, one and a half to two times as long as the calyx, very shallowly trilobed or emarginate at the apex, narrowed at the base, yellow or white; stamens short, included, mostly unequal; ovary globose, styles long, divergent, erect; ovules 8–12; capsule long-ovoid, as long as calyx. Fl. Jun.–Jul.

On stony and dry clay hills.

Type: Turkey: Wilayet Elaziğ (Cappadocia), along the Euphrates, Aucher 549. Holotype (G-Boissier not seen), isotype (FI).

Geographic distribution: S. Transcaucasia and E. Turkey.

TURKEY: Wilayet Elaziğ (Cappadocia), eastern part. De Montbret 2381 (FI); Wilayet Erzincan: Egin, Kota, Sint 2846 (JE); Wilayet Mus: between Sekavi and Czarbokh along the river Murad-czaj, Siškin 1916 (LE); along the river Sonamur-su, Saposhnikov 1916 (LE); Wilayet Kars, Woronov 12307 (LE). ARMENIA: Prov. Yerevan, coll.? (LE).

118. *G. fedtschenkoana* Šiškin, Not. Syst. Herb. Hort. Bot. U.S.S.R. 4, pt. 3: 7 (1926); Komar., Fl. U.S.S.R. 6: 770, t. XLVIII, f. 4. (1936).

Plate XVI, Fig. 32–37. p. 149

Perennial; stem branched from base to top, erect or ascending, 40–80 cm high, glandular-pubescent, more or less viscid; leaves ovate to lanceolate, the basal ones, connate, amplexicaul, with 5–7 nerves, glabrous or glandular-pubescent, 3–6 cm long and 1–3 cm broad; inflorescence with very many flowers, dichasial, with spreading branches; pedicel equalling the calyx, to 3 cm long, glandular-hairy, erect; bracts lanceolate, acuminate; calyx campanulate-tubiform, glandular-hairy, 4–7 mm long and 2.5–4 mm broad, incised to the middle, with ovate obtuse teeth, green bands trinerved, nearly twice as broad as the scarious intervals; petals subspatulate, two times as long as the calyx, emarginate to shallowly bilobed; stamens as long as the calyx or shorter; ovary globose; styles divergent, long, ovules 12–16; capsule subglobose, nearly as long as the calyx. Fl. May–Jun.

On stony hills.

Type: E. Turkestan: distr. Przewalsk: Toguztorau along the river Kugart, near Taldy-bulak, Saposhnikov s.n. 10 VI 1913 (LE not seen).

Geographic distribution: Middle Asia: Tien Shan (Kugart), Pamir-Alai (Gazi-Maylik).

TURKESTAN: Korshinsky 2887 (BM); Fergana, Kirgiz; near Dzhahal Abad, D. Litwinow s.n. 1913 (W).

119. *G. villosa* Barkoudah sp. nov.

Plate XVI, Fig. 38-43. p. 149

Perennis? (radix deest), glaucescens; caulibus 30-40 cm altis, albo-purpureis, omnino trichotomo-vel dichotomo-ramosis, glaberrimis; foliis ovatis vel lanceolatis, tri- vel multinerviis, glauco-purpureis, 2-5 cm longis et 1-2 cm latis, acuminatis, sessilibus et praesertim inferioribus amplexicaulibus; inflorescentia dichasiali, diffusa, villosa, pedunculis pedicellisque purpureis; bracteis lanceolatis acuminatis, facie dorsali villosis, margine scariosis; pedicellis patentibus, rigidis, villosis, calyce tubuloso, villosa, 5-7 mm longo, 1.5-2 mm lato, sepalis trinerviis, parte nervata viridi, interstitiis membranaceis pellucidis pallidis junctis, tubo calycis limbo triplo longiore, dentibus ovatis obtusis, margine scariosis; petalis linearibus, calycem paulo vel medio superantibus, bilobis vel emarginatis, ad basim angustatis, roseo-purpureis?; staminibus calyce aequilongis vel brevioribus; ovario ovoideo, stylis brevibus, divergentibus; ovulis 8; capsula globosa, 4-5 mm longa, quadrivalvi; semina 1.5 × 1.5 mm, tuberculata, gibbosa radícula saliente.

Type: Tadzhikistan: Top of Mt. Babatag between Bibi oko and Ojbulak, on bare gypsum hill, 1850 m alt., A. Linčefski 349 (LE).

*G. villosa* is closely allied to *G. fedtschenkoana* Siškin. It differs by its glabrous stem and leaves (only the inflorescence is villose), its tubiform calyx (1.5-2 mm wide), its longer calyx tube and its only 8 ovules.

120. *G. pilosa* Hudson, Philosophical Transact. 56: 252 (1767).

Heterotypic synonyms: *Silene porrigens* Gouan ex L., Syst. ed. XII, 3: 230 (1768); Gouan, Illustr. 29 (1773); *Saponaria porrigens* (Gouan) L., Mant. Alt. 239 (1771); *Hagenia filiformis* Moench., Meth. 61 (1794); *Gypsophila porrigens* (L.) Boiss., Fl. Or. 1 557 (1867); and of other authors. Authentic specimen: *Saponaria porrigens* L. 580, 5 (LINN).

Icon.: Jacquin, Hort, Vindob. P., t. 109 (1776).

Plate XVII, Fig. 1-9. p. 154

Annual; stem erect, 15-80 cm high, branched in the upper part, glabrous at the base and above, hispid in the middle part, sometimes also in the inflorescence; hairs ca. 1-1.5 mm long, patent; leaves lanceolate to broadly lanceolate, less hairy than the stem, sometimes glabrous, 3-9 cm long and 1-2 cm broad, with 3-5 nerves, acuminate, shortly connate at base; inflorescence lax, dichasial; pedicel capillary, glabrous, 1-4 cm long; bracts leafy, linear-lanceolate, hairy on the lower surface; calyx campanulate-tubiform, 5-6 mm long and 2.5 mm wide, hispid, incised to 1/4th or 2/5th of its length, with triangular, acute to obtuse teeth, scarious on the border; petals one and a half to two times as long as the calyx, linear-oblong, with a contraction be-

tween the limb and the claw, emarginate to shallowly bilobed, white to flesh-coloured; stamens shorter than the calyx; ovary ellipsoid, styles short, divergent, ovules 16–20; capsule broadly ovoid, deeply four-valved, as long as the calyx; seeds 1.5 mm × 1.5 mm, with acute tubercles. Fl. April–Jun.

A species of ruderal places and fields.

Type: Cultivated in Chelsea Gardens (BM)!

Geographic distribution: Afghanistan, S. Turkmenia, Iran (except the S.E. part), Iraq, Jordan, Palestine, Kuwait, Syria, Turkey, S. Transcaucasia, adventive in Europe, probably naturalized in Mallorca.

AFGHANISTAN: without exact locality, Griffith (K, L). TURKMENIA: near Ashkhabad, Litwinow 24 (M). IRAN: near Tehran, Bunge s.n. 1859 (FI, L). IRAQ: Mesopotamia, without locality, Aucher 632 (FI). KUWAIT: Dickson 308 (K). PALESTINE: Jerusalem, Dinsmore 8007 (E). SYRIA: Wadi Barada, near Damascus, Bourgeau 329 (G, K). TURKEY: Wilayet Antalya; Isparta, Heldreich s.n. 1845 (FI, G). ARMENIA: Szovits 390 (K, L, M).

121. *G. platyphylla* Boissier, Fl. Or. Suppl. 87 (1888); Parsa, Fl. de l'Iran I, (2): 1033 (1951).

Plate XVII, Fig. 10–16. p. 154

Perennial?; glandular-pubescent, more or less viscous; stem erect, yellowish, 30–50 cm high, branched above, internodes 5–7 cm long; leaves broadly ovate, tapering at base, sessile, basal ones falling, cauline ones 3–4 cm long and 2.5 cm broad, rather fleshy; inflorescence lax with very many flowers, dichasial, bracts lanceolate, acuminate, scarious, glandular-pubescent; pedicel 1–3 cm long, mostly 1.5 cm, rigid, glandular-pubescent; calyx turbinate-tubiform, 4–5 mm long, 1.5 mm wide, glandular-puberulent, incised to one third, with ovate acuminate teeth, green, bands slightly broader than the scarious intervals, trinervate; petals linear, one and a half to two times as long as the calyx, with a shallow contraction between the limb and the claw, emarginate or shallowly bilobed, angustate at the base; stamens shorter than the calyx, mostly unequal, ovary globose; styles short, divergent; ovules 8; capsule globose, as long as the calyx; seeds 2 mm × 2 mm, with flat tubercles. Fl. Jul.

On schist rocks and on rocky slopes, ca. 1500 m alt.

Type: Iran: Prov. Kermanshah: Mt. Ovraman, Haussknecht 183, Jul. 1867. Holotype (G-Boiss.), isotypes (BM, JE, K, P).

IRAN: southern part, Aucher-Eloy 1378 (P).

122. *G. boissieriana* Haussknecht et Bornmüller, Beih. Bot. Centralbl. 38, (II): 137 (1911).

Homotypic synonym: *Saponaria boissieriana* (Hausskn. et Bornm.) Preobrashinsky ex Popov, Trav. Turkest. State Univer. n. 4: 24 (1922).

Misapplied name: *G. platyphylla* auct. non Boiss.; Blakelock, Kew Bull. 2: 194 (1957) in part.

Plate XVII, Fig. 17–22. p. 154

Perennial, whitish-glaucous; root thick, woody, brown; stems few,

stout, 5–10 mm thick, glabrous, branched throughout, with 2.5–6 cm long internodes, 50–70 cm high, erect; basal leaves spatulate to ovate, acute to rotundate, narrowed at base, 5–7-nerved, 7–10 cm long and 2–3 cm broad, the cauline ones broadly lanceolate to lanceolate, smaller than the basal ones, glabrous; inflorescence dichotomous and trichotomous below, twice dichasially compound above, last internodes and flowers glandular-pubescent, with scattered patent hairs; bracts lanceolate, acuminate, glandular-hairy on the lower surface, scarious; pedicel up to 1.5 cm long, mostly as long as the calyx, glandular-hairy; calyx tubiform, 6–8 mm long and 2–2.5 mm wide, incised to  $\frac{1}{4}$ th, with triangular acuminate spreading teeth, green bands as broad as or slightly broader than the scarious intervals, trinervate, loosely glandular-hairy; petals linear-cuneate, truncate, white to pink, twice as long as the calyx and 1.5 mm broad; stamens longer than the calyx, divergent; ovary narrowly ovoid; styles long, parallel; ovules 12–16. Fl. Jun.–Aug.

In rocky places and on open patches in *Quercus* forests.

Type: N. Iraq: Irbil distr.: Rawanduz, Mt. Sakri-Sakran. 2100 m alt., J. Bornmüller 957, 23 VI 1893. Holotype (B destroyed), isotypes (BR, JE, K, P).

Geographic distribution: N.E. Iraq.

IRAQ: North of Sulaymaniyah, Pir Omar, Gudran, Haussknecht 182 (K, P); Kopi Qara Dag, South of Sulaymaniyah, Wheeler Haines W. 1168.B (K); Kandil range, north of Irbil, near Pishtashan, Rawi and Serhang 18301 (K).

The points in which *G. boissieriana* differs from *G. platyphilla* may be summed up as follow: Only the ultimate internodes of the inflorescence are glandular-hairy; the stem is thicker and higher; the pedicel is glandular-hairy; the calyx is longer, with acuminate teeth; the petals have no contraction between the limb and the claw, the stamens are longer than the calyx, spreading; the styles are long, parallel; the ovules are only 12–16.

### 123. *G. nodiflora* (Boissier) Barkoudah comb. nov.

Basionym: *Saponaria nodiflora* Boissier, Diagn. ser. 1 (I): 15 (1842); Boiss., Fl. Or. 1: 544 (1867); Simmler, Monographie der Gattung *Saponaria* 71 (1910).

Plate XVII, Fig. 23–30. p. 154

Perennial; stems few, erect, 40–60 cm high, tinged with purple, glabrous below, glandular-hairy above, branched, the branches mostly as long as the main stem; leaves nearly all basal, spatulate with round apex, narrowed at the base, 3–5-nerved, 2.5–5 cm long and 1–2 cm broad, the cauline ones oblong-lanceolate, smaller; inflorescence dense, dichasial, capitate, sessile, axillary, semiverticillate; bracts broadly lanceolate to lanceolate, acuminate, glandular-hairy; pedicel absent; calyx tubiform, 7–8 mm long and 2.5 mm wide, glandular-hairy, incised to  $\frac{1}{4}$ th, with ovate obtuse or apiculate teeth, green bands as broad as the scarious intervals; petals linear-triangular, one and a half to two times as long as the calyx, shallowly bilobed, with sinuate apex; stamens nearly as long as the calyx, ovary globose-obovoid, styles long, incurved, stigmatic surface oblong; ovules 16; capsule globose, shorter than the calyx and covered by it, four-

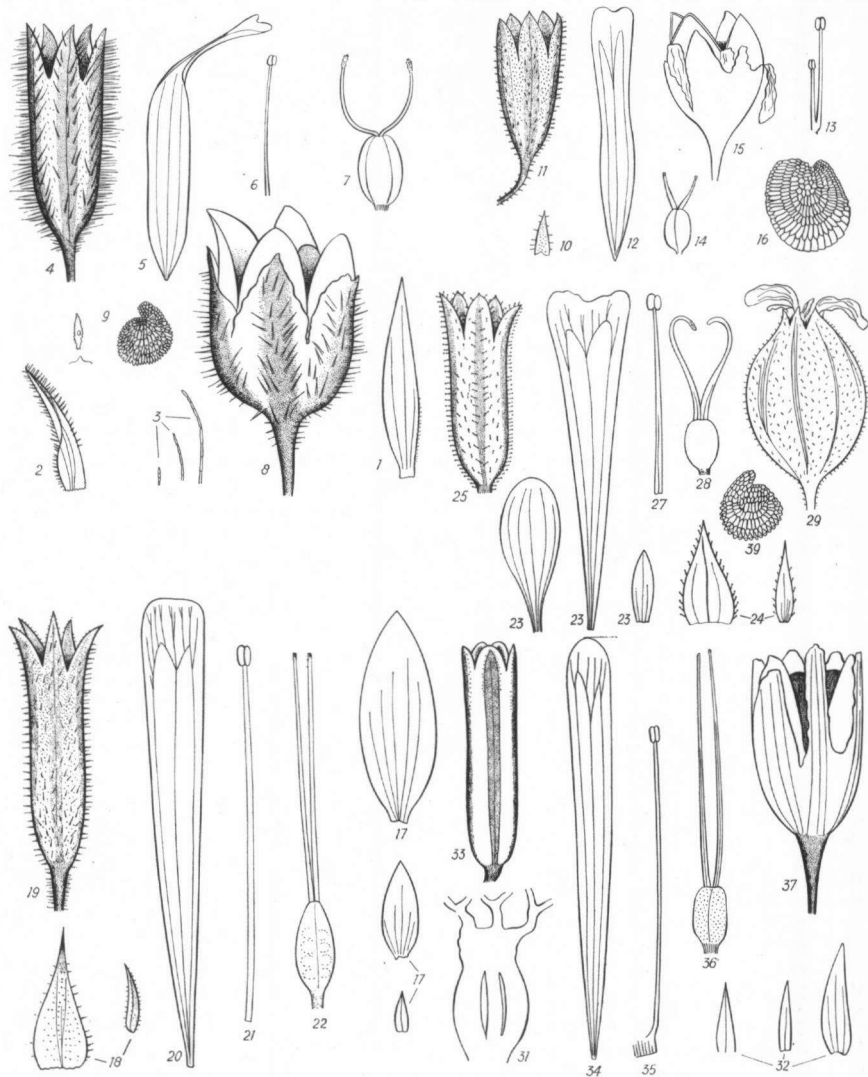


Plate XVII. Fig. 1-9: *G. pilosa*; 1: leaf; 2: bract; 3: hairs; 4: calyx; 5: petal; 6: stamen; 7: ovary; 8: capsule; 9: seed and tubercle. Fig. 10-16: *G. platyphylla*; 10: bract; 11: calyx; 12: petal; 13: stamens; 14: ovary; 15: capsule; 16: seed. Fig. 17-22: *G. boissieriana*; 17: leaves; 18: bracts; 19: calyx; 20: petal; 21: stamen; 22: ovary. Fig. 23-30: *G. nodiflora*; 23: leaves; 24: bracts; 25: calyx; 26: petal; 27: stamen; 28: ovary; 29: capsule; 30: seed. Fig. 31-37: *G. bucharica*; 31: root and caudex; 32: leaves; 33: calyx; 34: petal; 35: stamen; 36: ovary; 37: capsule.

valved; seeds 2 mm × 2 mm, with acute tubercles on the back, compressed on both sides. Fl. Jun.–Jul.

On eroded shaley banks.

Type: Turkey: Wilayet Malatya: between Besni and Malatya, Aucher-Eloy 636 (G-Boiss.)

Geographic distribution: Only known from Central Turkey.

TURKEY: Wilayet Elazığ; Maden, Davis and Hedge D. 28883 (E).

When Boissier described this species in 1842, he placed it in the Sect. *Bootia* of *Saponaria*. In *Flora Orientalis* 1: (1867) it was transferred to the Sect. *Otitoides* which has dense semiverticillate inflorescences. Boissier admitted, however, that the specimen which he examined was fragmentary. SIMMLER (1910) listed this species under "species dubiae". He wrote that the material at his disposal was insufficient and in fruiting stage, so that he was unable to study the flower morphology. He added: "somit stehe ich der Zugehörigkeit der Art unserer Gattung *Saponaria* kritiklos gegenüber". *G. nodiflora* (Boiss.) Barkoudah shows some similarity to the genus *Saponaria* in its rather large flowers and tubiform, toothed calyx. However, some of its other characters are more typical for *Gypsophila*. The scarious bracts, the scarious intervals between the green bands in the calyx, the absence of corona appendages or claw wings in the petals, the globose-obovoid ovary, the terminal stigmatic surface, the globose capsule, and the seeds with a distinctly prominent radicle are all typical *Gypsophila* characters. Moreover, *G. nodiflora* shows definite relationship to the members of the series *Hispidae* of *Gypsophila* and no direct affinity with any *Saponaria* species.

## Series 2. Bucharicae (Fedtsch.) Barkoudah p. 46

124. *G. bucharica* Fedtschenko, Act. Hort. Petr. 32: 7 (1911); Fedd Repert. 11: 313 (1912); Komar., Fl. U.S.S.R. 6: 771 (1936).

Homotypic synonym: *Saponaria bucharica* (Fedtsch.) Preobrashensky, Trav. Turkest. State Univ. 4: 24 (1922).

Plate XVII, Fig. 31–37. p. 154

Perennial; root long, tuberous, very thick, thick part ca. 10 cm long and 2–4 cm in diam.; stems few, ascending, branched from base to top, 10–20 cm high, internodes 2–6 cm long; leaves lanceolate, 3–6 cm long and 5–8 mm broad, 1–3-nervate, sessile, more or less clasping; inflorescence lax, dichasial; bracts lanceolate, leafy; pedicel 1–3 cm long, erect; calyx tubiform 7–10 mm long and 1.5 mm wide, with small, semicircular teeth, green bands trinervate, narrower than the scarious intervals; petals linear-cuneate, twice as long as the calyx, purplish pink; stamens longer than the calyx, spreading; ovary short-cylindrical, styles long, parallel; ovules 12; capsule oblong, shorter than the surrounding calyx, ca. 6 mm long, four-valved; seeds 2 mm × 2 mm, with very small tubercles. Fl. May–Jun.

On dry hills, ca. 2000 m alt.

Type: U.S.S.R., Middle Asia: Pamir-Alai (Tadzhik), along the river Vaksh near Tutkaul, G. Morren s.n. 8 V 1906. Holotype (LE), isotype (BM, K, M.).

Geographic distribution: U.S.S.R., Pamir-Alai.

E. TADZHİK: W. Sanglak Mountains, Gouttscharow and Grigoriev 305 (LE).

125. *G. intricata* Franchet, Annal. Sc. Nat. ser. VI, 15: 238 (1883); Komar., Fl. U.S.S.R. 6: 771 (1936).

Plate XVIII, Fig. 1-9. p. 158

Root tuberous; tubers few, globose or oblong, 1-5 cm in diam.; stems 30-50 cm high, branched from base to top, glabrous, capillary, the branches intricate in the upper part, internodes 1-3 cm long; leaves subcarnose, most of them congested at the stem base, oblong, 1-3 cm long and 3-7 mm broad, acute to acuminate, the cauline ones sometimes linear, obtuse, 2-3 cm long and 2-3 mm broad; inflorescence lax, dichasial, with scattered glandular hairs above the nodes; bracts triangular, acute to acuminate, scarious; pedicel capillary, up to 2.5 cm long, mostly 1.5 cm; calyx tubiform, 3-4.5 mm long and 2 mm wide, teeth small, ovate, acute to obtuse, green bands narrower than the scarious intervals; petals linear, 2-3 times as long as the calyx, with a shallow contraction between the limb and the claw, truncate to shallowly emarginate, white; stamens shorter than the calyx, mostly unequal; ovary obovoid, styles short divergent; ovules 8; capsule shorter than the calyx, oblong, ca. 3.5 mm long; seeds 1.5 mm  $\times$  1.5 mm, with flat tubercles. Fl. May-Jul.

On clay and calcareous hills and on rubble slopes.

Type: U.S.S.R., Pamir-Alai: Tshukalik opposite Urmitan, Capus 202. Holotype (LE not seen), isotype (P).

Geographic distribution: U.S.S.R. Tadzhik and Kirgiz S.S.R.

TADZHIK: basin of the river Zerafshan, west of the river Kshtut near the mouth of the Kishlak river, Ovczinnikov 305 (LE). TURKESTAN: Mts. Maikot-saj?, Massagetov 111 (LE); Zerafshan: Kshtut, V. L. Komarov s.n. (K); *ibid.*, south of the river Pemdchakent, A. Regel s.n. 1882 (K).

### Series 3. *Venustae* Barkoudah p. 46

126. *G. venusta* Fenzl, Pugill. Pl. Nov. Syria et Taur 9 (1842); Boissier, Fl. Or. 1: 541 (1867); Post, Fl. Syr Pal. ed. 2.1: 165 (1932);

Heterotypic synonym: *G. wiedemanni* Boissier, Fl. Or. 1: 541 (1867); Bornmüller, Fedde Rep. Beih. 891: 102-105 (1940). Type: Turkey, Dykmen, near Ankara, Wiedeman (not seen). Topotype: Bornmüller 13327 (BM, K)!

Plate XVIII, Fig. 10-17. p. 158

Perennial; stems few, ascending, whitish, glabrous, branched above, 50-100 cm high, internodes 2-4 cm long; leaves lanceolate, 2-5 cm long and 5-15 mm broad, 3-5-nervate; inflorescence lax, paniculate-dichasial; bracts lanceolate to triangular, acuminate, with scarious border; pedicel to 2.5 cm long, capillary; calyx tubiform-turbinate, 3.5-5 mm long and 2.5-3 mm wide, teeth semicircular, green bands trinervate, as broad as the scarious intervals; petals one and a half to two times as long as the calyx, cuneate to linear-cuneate, truncate to shallowly emarginate, white with reddish veins; stamens nearly as long as the calyx or slightly exserted, mostly unequal, ovary obovoid; styles short, divergent; ovules 12; capsule obovoid-globose, mostly dehiscent irregularly, rarely four-valved, as long as the calyx;



seeds 1.5 mm  $\times$  1.5 mm, with acute tubercles on the back. Fl. May-Jul.

On steppe, fallow fields and cultivated land.

Type: Syria: Aleppo, Th. Totschy 221. Holotype (Not seen), Isotypes (JE, L, M).

Geographic distribution: N. Syria, C. and S. Turkey; reported from E. Iran, possibly in error.

SYRIA: between Gaziantep and Aleppo, Haradjian 1487 (W). TURKEY: Wilayet Urfa: Tchermelik?, Sint 847 (BR, E), Urfa-Hilvan, 11 km from Urfa, Davis and Hedge D. 28204 (E, K); Wilayet Gaziantep: between Gesiantep and Nizip, near Orum, Haussknecht 543 (JE), Gaziantep, Haussknecht s.n. (JE), Nizip, Haussknecht s.n. (K, P), between Gaziantep and Maras, Haradjian 1487 (K); Wilayet Diyarbakir: between Elagiğ and Diyarbakir, Iter Leiden (1959) 1499 (L); Wilayet Elaziğ: Harput, Sint 671 (BR, JE, K); Wilayet Erzincan: (Cappadocia) along the Euphrates, Aucher 546 (BM, Fl, K, P); Wilayet Malatya: between Hekimhan and Malatya, Stainton and Henderson 5450 (E); Wilayet Erzurum: Horasankala-Pasinler, Davis and Hedge D. 30786 (E, K); Wilayet Girezun: near Susehri, Bornmüller 998 (JE); Wilayet Kaysari: Bakirdagi near Develi, Davis 19187 (Dodds, Cetik) (E, K), Sinas-Kaysari, Bornmüller 1968 (JE); between Yozgat and Kaysari, near Keller, Bornmüller 1969 (JE); between Bakirdagi and Pungu, Hubert-Morath 11132 (HUJ); Wilayet Çankiri: Çakmakli-dere, Bornmüller 13328 (BM, P); Wilayet Ankara: Ankara-Gölbasi, Birand and Zohary 2933 (HUJ); Yenisehir, Kotte s.n. 1932 (K).

### BOLANTHUS

*Bolanthus* (Seringe) Reichenbach, Herb. Buch. (Nom.) 205, Jul., (1841); *Saponaria* L. sect. *Bolanthus* Ser. in DC., Prod. 1: 366 (1824); *Gypsophila* L. sect. *Bolanthus* Boiss., Fl. Or. 1: 537 (1867).

The name *Bolanthus* was first used by SERINGE in DE CANDOLLE'S Prod. I: 366 (1824) for a section of the genus *Saponaria*. It included the following species: *Saponaria hirsuta* Labil., *S. depressa* Biv., *S. caespitosa* DC., *S. lutea* L., *S. bellidifolia* Smith., *S. smithii* Ser., and *S. saxatilis* Bory. All these species are typical representatives of *Saponaria*, except *S. hirsuta* Labil. which is a true *Bolanthus*, and *S. smithii* Ser. which is a *Silene*. FENZL, in ENDLICHER, Gen. Pl. (1836-40), kept this section under *Saponaria*. The next author who used the name was REICHENBACH (1841). He raised the section *Bolanthus* to the rank of a genus, without, however, giving a description or indicating its delimitation from other genera. A. BRAUN (in Flora 1839) put *Saponaria hirsuta* Labil. under *Gypsophila*, stating that it probably represented a separate section. He added that he was not sufficiently familiar with its characters to determine its right place. BOISSIER (1867) put *Bolanthus* under *Gypsophila* as a section, giving the following comment: "Petala patentia *Saponariae* cui saepe adnumeratae sunt sed calyx late membranaceus *Gypsophilae* et radícula prominens". WILLIAMS (1889) excluded the section *Bolanthus* from *Gypsophila* and in agreement with Seringe he returned it to *Saponaria*. Most subsequent authors followed Boissier, though some of them admitted that Williams was probably right in changing the position of this section. PAX and HOFFMANN (1934) were of this opinion.

This review of the history of the group shows that its position

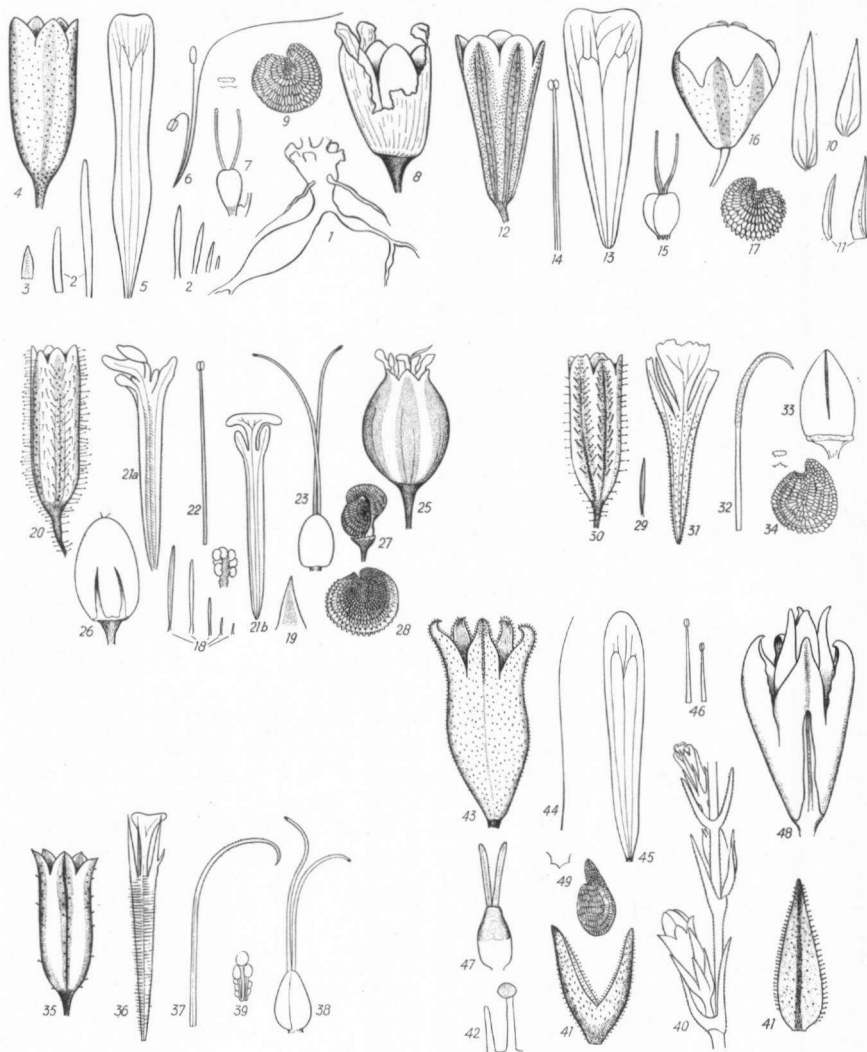


Plate XVIII. Fig. 1-9: *G. intricata*; 1: root; 2: leaves; 3: bract; 4: calyx; 5: petal; 6: petal and two stamens; 7: ovary; 8: capsule; 9: seed and tubercle. Fig. 10-17: *G. venusta*; 10: leaves; 11: bracts; 12: calyx; 13: petal; 14: stamen; 15: ovary; 16: capsule; 17: seed. Fig. 18-28: *A. gypsophiloides* var. *gypsophiloides*; 18: leaves; 19: bract; 20: calyx; 21: petals; 22: stamen; 23: ovary; 24: placenta; 25: capsule; 26: placenta with seeds; 27: seed; 28: seed. Fig. 29-34: *A. reuteri*; 29: leaf; 30: calyx; 31: petal; 32: stamen; 33: capsule; 34: seed and tubercle. Fig. 35-39: *A. arsiusianum*; 35: calyx; 36: petal; 37: stamen; 38: ovary; 39: placenta. Fig. 40-49: *Ph. ortegioides*; 40: a piece of a stem; 41: two bracteoles; 42: hairs; 43: calyx; 44: longitudinal and cross-sections of a petal; 45: petal; 46: stamens; 47: ovary; 48: capsule; 49: seed

formed for a long time and still forms a point of discussion. After studying the species of this section, the present author concluded that though they show a strong relation with the genus *Gypsophila* on the one hand and with the genus *Saponaria* on the other, they form a unique group with special characters that permit us to regard it as a separate genus.

#### 1. DIAGNOSIS AND DELIMITATION FROM OTHER GENERA

Calyx without bracteoles, tubiform, pentagonal, turbinate at base, with small teeth and with 5 projecting ribs alternating with comparatively broad hyaline bands; petals cuneate, with long linear claw and small spreading limb, the claw delicately winged on the inner side; androphore present; stamens 10, as long as the calyx or slightly longer; ovary ovoid, on a short gynophore, with subexserted parallel styles, the latter stigmatose all along the inner side; ovules numerous, arranged in four series on a long placenta; capsule oblong-ovoid to urceolate, dehiscing with 4 teeth; seeds many, comma-shaped, compressed on both sides, with flat or channelled back; testa with small tubercles; hilum marginal; embryo hook-shaped, with long prominent radicle, peripheral.

Perennial, puberulent to hirsute, grey-green to velvety herbs with thin short stems and small leaves; inflorescence contracted; bracts foliaceous; pedicel mostly shorter than the calyx.

Type species: *Bolanthus hirsutus* (Labil.) Barkoudah.

Though this genus is in some characters similar to *Saponaria*, it differs clearly from it in other respects. These differences can be summed up as follows:

1) The calyx is pentagonal, turbinate at base, narrow, without any trace of anastomosing veins, with thick ribs alternating with broad hyaline intervals; no *Saponaria* species has a calyx with this combination of characters.

2) The petals of *Bolanthus*, though patent like those of *Saponaria*, are not provided with a corona; the claw is very minutely winged, and the neck between the limb and the claw is mostly papillose; across the limb mostly a characteristic purple stripe is present.

3) The *Bolanthus* ovules, especially the upper ones, have long funicles, and this is not so in *Saponaria*.

4) The *Bolanthus* seeds are comma-shaped and compressed, not globose as in *Saponaria*. The embryo is hook-shaped and provided with a long projecting radicle, not circular as in *Saponaria*.

5) Moreover, *Bolanthus* has a typical habit which differs from that of *Saponaria*.

From the related genus *Gypsophila*, *Bolanthus* differs in the following points:

1) The calyx of *Bolanthus* is tubiform, pentagonal, with small teeth and without calcium oxalate druses in its parenchyma, while the calyx of *Gypsophila* is campanulate and mostly well provided with this kind of druses.

2) The petals of *Bolanthus* show a differentiation into a limb and a claw, and they are patent, with a winged claw and a mostly papillose neck; this is never so in *Gypsophila* species. The purple cross stripe is also typical for *Bolanthus*.

3) *Bolanthus* flowers have always a distinct androphore and gynophore, while *Gypsophila* species do not possess such parts.

4) The ovary of *Bolanthus* is elongate-ovoid and provided with parallel styles which are stigmatose all along their inner side; this is rarely so in *Gypsophila*.

5) The capsule of *Bolanthus* is narrowly ovoid or urceolate and dehisces by 4 teeth, and not globose and 4-valved as in *Gypsophila*.

6) *Bolanthus* seeds are comma-shaped with flat back, not ear-shaped with a convex back. The embryo of *Bolanthus* is hook-shaped with a more distinctly projecting radicle than we find in the embryo of *Gypsophila*.

## 2. GEOGRAPHY

*Bolanthus* inhabits a more or less continuous area which extends from Greece through South Turkey to the coastal mountains of Syria, Lebanon and Palestine. Its species occupy small areas which do not overlap. The taxonomic identity of the species occurring in Greece and the coastal part of Syria and Palestine is also observed in some other genera, e.g. in *Parietaria cretica* L., *Sideritis curvidens* Stapf, *Teucrium hirtum* Willd., *Micromeria myrtifolia* Boiss. & Hohen., *Genista sphacelata* Decne, *Campanula sulphurea* Boiss., as RECHINGER f. (1949) showed by means of distribution maps. EIG (1931) considers a great part of Greece, South Turkey and the coastal mountains of Syria, Lebanon and Palestine as part of the east-mediterranean phytogeographic subregion. It would be worthwhile to investigate whether *Bolanthus* species are elements of a denuded maquis belonging to the last-mentioned subregion.

*Bolanthus* species are all mountain plants. They are found at altitudes ranging from 500 up to 2500 m. They grow mostly in crevices of calcareous rock and on stony slopes.

## 3. GENERAL MORPHOLOGY

So far as we know, the species of the genus *Bolanthus* are very similar to each other in habit. The thick woody caudex, the several stems which are renewed every year, and the small leaves and flowers are very similar in all its species. The perennial habit and the strong root may be regarded as adaptations to their special habitat. The difficulties afforded by arid and stony slopes, in a region with a dry and hot summer, can only be overcome by plants with a chamaephytic habit. A short stem and small, more or less fleshy leaves are often recurring adaptations to a mountain habitat. Branching is not abundant, except in the inflorescence, which is more or less condensed to a capitulum.

A remarkable fact here is the richness and the range of variability shown by the indumentum. There are the simple small eglandular

hairs of *Bolanthus cherlerioides* (Bornm.) Bark., the simple glandular hairs of *B. frankenioides* (Boiss.) Bark., and the mixed indumentum of the other species. This last type is composed of two sorts of hairs differing in length and sometimes in the presence or absence of an apical glandular swelling. The hairy indumentum obviously is a protection against drought during the hot season, and the fleshy habit has a similar function.

The number of flowers in these plants is small in comparison to that found in the *Gypsophila* species. The dichasial nature of the inflorescence can only be recognized by close examination, because it is obscured by the contraction of the inflorescence and sometimes, as in *B. frankenioides* (Boiss.) Bark., by the abortion of the branches at one side of the dichasium. The pedicel is rarely longer than the calyx and bracts are always foliaceous and small.

Though the calyx has the same hyaline intervals between the ribs as are found in *Gypsophila*, the ribs themselves are strongly projecting, which gives the tubiform calyx a pentagonal shape. The teeth are very small in comparison with the total length of the calyx. The aestivation of the teeth is imbricate, but this can only be seen in young buds, because afterwards the teeth stand apart in order to make room for the development of the other floral parts. It is noteworthy that the calyx teeth develop before the connate part of the calyx; this is just as in *Gypsophila*.

The petals mostly show a spreading limb and a long linear claw separated from the limb by a contraction. This character is found also in *Saponaria*, but in *Bolanthus* no corona is present. The minute wings on the claw are excrescences of the upper surface of the petals: under the microscope one can see that the epidermis of the upper surface of the petals passes into them. The aestivation of the petals (so far as I could learn from the flowers which I examined) is mostly dextrorsely contorted, i.e. just as in *Gypsophila*.

The stamens are subexserted with filiform filaments and oblong anthers. In the bud, the episepalous stamens are longer than the epipetalous ones, but this difference in length gradually disappears so that they become equal in length when the flower opens. The androphore is recognisable and resembles a short internode separating the calyx from the corolla. The styles which are slightly exserted are stigmatose all along their inner side. Cross-fertilization can easily be realized in this way, because the long-tongued insects which visit these flowers in search of the nectar secreted by the disc, bring with them pollen grains from other flowers, and these pollen grains are easily given off to the various parts of the stigmatic surface with which the proboscis comes into contact.

The capsule opens at the level of the calyx mouth by four teeth. The capsule itself is shorter than the calyx which continues to surround it, but the presence of the androphore and of the gynophore makes that its top reaches the mouth of the calyx. This facilitates the release of the seeds.

## 4. RELATION WITH OTHER GENERA

This genus may be placed between *Gypsophila* and *Saponaria*. The similarity to *Gypsophila* is especially striking in the species *B. frankenioides* (Boiss.) Bark. The absence of a corona in the corolla and the general morphology of the seeds bring it very near to *Gypsophila*. This affinity with *Gypsophila* can be recognized especially in two subgenera of the latter, viz. *Gypsophila* and *Macrorrhizaea*. On the one side there are *Gypsophila tubulosa* (Jaub. & Sp.) Boiss. and *G. confertifolia* Huber-Morath (subgenus *Macrorrhizaea*), which are not only similar to *Bolanthus* in their general habit, but show also a similar geographic distribution. On the other side there is *Gypsophila antoninae* Šiškin (subgenus *Gypsophila*), which is also similar to this genus. This may mean that such species of *Gypsophila* as the last-mentioned ones have developed to some degree along similar lines as those of *Bolanthus*, but that they did not obtain the whole set of *Bolanthus* characters. It has to be kept in mind that this does not mean that such *Gypsophila* species will ever change into *Bolanthus* species, but that the genus *Gypsophila*, which comes nearest to the primitive type of the *Silenoideae*, reveals in some of its species part of the evolutionary tendencies which may have given rise to such genera as *Bolanthus*.

The similarity of the genera *Bolanthus* and *Saponaria* appears in their tubiform calyx, the more or less distinctly differentiated petal limb, and a stigmatose surface extending all along the inner side of the styles. But this similarity is restricted to definite characters, and I do not know a single *Saponaria* species which may be confused with a *Bolanthus*. Yet, the similarity between these two genera can be explained by supposing that both genera developed from gypsophiloid ancestors. This same supposition can be applied also to the similarity between *Bolanthus* and *Acanthophyllum*.

## 5. KEY TO THE SPECIES

1. Plants stemless or with prostrate stem, cushion-shaped, less than 5 cm high; leaves subulate ..... 2  
Plants not so ..... 3
2. Stem densely puberulent; flowers exclusively terminal (circ. 3), sessile; ovules 8 ..... 8. *B. cherlerioides* (Bornm.) Bark.  
Stem with scattered glandular hairs; flowers terminal and axillary; pedicel as long as calyx; ovules 20 7. *B. frankenioides* (Boiss.) Bark.
3. Plant nearly glabrous, the hairs that are present either glandular or eglandular, but always all of the same length; leaves less than 1.5 mm wide, more or less subulate .. 1. *B. laconicus* (Boiss. & Heldr.) Bark.  
Plant pubescent to hirsute, with two kinds of hairs differing in length; leaves flat ..... 4
4. Stem and leaves pubescent ..... 5  
Stem and/or leaves hirsute ..... 6
5. Leaves with rounded apex; calyx ribs with long glandular hairs; plants from Syria and Lebanon ..... 5. *B. filicaulis* (Boiss.) Bark.

- Leaves with acute to acuminate apex; calyx ribs with long eglandular hairs; plants from Greece ..... 4. *B. graecus* (Schreb.) Bark.
6. Calyx shorter than 5 mm, tubiform-urceolate; leaves and bracts glandular-pubescent; plants from the Near East .... 6. *B. hirsutus* (Labil.) Bark. Calyx 5–6 mm long, tubiform; leaves and bracts hirsute; plants from Greece ..... 7
7. Stem rigid, erect; leaves small and spatulate; pedicel pubescent; seeds with flat tubercles ..... 2. *B. fruticosus* (Bory & Chaub.) Bark. Stem flexible; leaves lanceolate; pedicel hirsute; seeds with acute tubercles ..... 3. *B. thessalus* (Jaub. & Sp.) Bark.

## 6. SPECIES DESCRIPTIONS

### 1. *B. laconicus* (Boiss. & Heldr.) Barkoudah n. comb.

Based on: *Gypsophila fasciculata* Marg. & Reut. var. *laconica* Boiss., Fl. Or. 1: 556 (1867); *Gypsophila laconica* Boiss. & Heldr. ex Boiss., Fl. Or. Suppl. 88 (1888); E. Halácsy, Consp. Fl. Graec. 1: 190 (1900); Hayek, Fl. Balc. 1: 220 (1927).

Plate XIX, Fig. 1–8. p. 165

Caudex thick woody giving rise to several thin stems; the latter 10–15 (–30) cm high, branched at the base only, sometimes purplish, pruinose to velvety, puberulent; leaves linear subulate, 1–2 cm long and circa 1 mm wide, slightly fleshy, hardly connate, obtuse; inflorescence capitate, terminal or, rarely, terminal and axillary; bracts small, subulate with expanded membranous base, shorter than the calyx; pedicel shorter than the calyx, circa 1 mm long; calyx puberulent, 3–4 mm long and less than 1 mm in diam., with small triangular, obtuse, slightly keeled teeth; petals cuneate, patent, white, with rounded apex, one third longer than the calyx; stamens nearly as long as the petals; ovules 8–12; seeds covered with small tubercles, 1 mm long, 0.7 mm broad and 0.3 mm thick. Fl. Jun.–Jul.; fr. Jul.–Aug..

On rocks and stony, exposed slopes, up to 1300 m.

Type: M. Páron, Peloponnesus, Greece, G. H. Orphanides 1. Fl. Graec., isotypes (L, BR, FI, JE, K).

Geographic distribution: Greece: Peloponnesus, Évvoia?

GREECE: Peloponnesus: Mt. Páron, Orphanides 927 (JE); near Agriani, Heldreich 302 (BR, FI, K); Mt. Taíyetos, Heldreich s.n. Jun. 1876 (L); *ibid.*, Pichler s.n. 1876 (K); near Maligali-Anastasowa, H. Zahn 1518 (JE, K, M, P); between Skála and Maláoi, 25 km E. of Skála, Rechinger f. 20011 (K); between Lada and Kanakia, below Kalamata. R. Maire & M. Petitmengin 1061 (K). Évvoia: near Steni, Pichler s.n. IV 1876 (FI, P).

This species was first regarded by Boissier as a var. of *Gypsophila fasciculata* Marg. & Reut. = *Tunica fasciculata* (Marg. & Reut.) Boiss. Afterwards Boissier and Heldreich recognized that this had been a mistake, and they made a separate species of it. In the first description of this plant as a var., Boissier mentioned two collections, one by Heldreich, the other by Orphanides. I have chosen here Orphanides' plant n. 1 as type specimen, because it is represented in more herbaria than that of Heldreich. The holotype may be present in Geneva (G-Boiss.); I only saw a number of isotypes.

2. *B. fruticosus* (Bory & Chaub.) Barkoudah n. comb.

Basionym: *Saponaria fruticulosa* Bory & Chaub., Fl. Pélop. (1838) n. 600, tab. XI, fig. 2.

Homotypic synonym: *Gypsophila fruticulosa* (Borg & Chaub.) Boiss., Fl. Or. 1: 556 (1867); Halácsy, Consp. Fl. Graec. 1: 190 (1900); Hayek, Fl. Balc. 1: 220 (1927).

Plate XIX, Fig. 9–17. p. 165

Caudex thick woody giving rise to a large number of stems; the latter erect, rigid, mostly unbranched, hirsute, with shorter and softer hairs between, 5–25 cm high, with 2.0–2.5 cm long internodes; leaves small, spatulate, 5–10 mm long and 2–3 mm wide, acute, hirsute, fleshy; inflorescence lax; pedicel about as long as the calyx; calyx hirsute with shorter and softer hairs between, 5–6 mm long and 1 mm in diam.; petals with purple cross stripe; ovules 12; seeds 1 mm long, 0.7 mm broad and 0.5 mm thick. Fl. Jul.; fr. Aug.–Sept.

On rocks and stony slopes up to 1000 m.

Geographic distribution: Greece: Peloponnesus, Central Greece, Thessaly, Évvoia.

Type: Ákra lérax, Peloponnesus, Bory s.n. 1833. Isotypes (FI, P).

GREECE: Peloponnesus: Mt. Párnon, in Herb. Zeccarini (M); *ibid.*, C. Fraas s.n. (M); Central Greece: Mt. Parnassós, C. Fraas s.n. (M); Thessaly, Berger s.n. (M); *ibid.*, in Herb. Zeccarini 1833 (M); Evvoia: near Limni, K. H. Rechinger 16681 (W); *ibid.*, K. H. Rechinger 16576 (W); near Mandóudhion, K. H. Rechinger 19439 (W).

3. *B. thessalus* (Jaub. et Sp.) Barkoudah n. comb.

Basionym: *Saponaria thessala* Jaub. et Sp., Pl. Or. ill. 5: 2, tab. 402 (1853–57).

Homotypic synonyms: *Gypsophila thessala* (Jaub. et Sp.) Halácsy, Consp. Fl. Graec. 1: 191 (1900); *Gypsophila polygonoides* (Willd.) Halácsy ssp. *thessala* (Jaub. et Sp.) Hayek, Fl. Balc. 1: 221 (1927).

Heterotypic synonyms: *Saponaria thymifolia* (Sibth. & Sm.) Boiss., Diagn. ser. 1, (i): 17 (1842), *haud quoad typum*; *Gypsophila hirsuta* (Labill.) Spreng. var. *thymifolia* (Sibth. & Sm.) Boiss., Fl. Or. 1: 556 (1867), *haud quoad typum* (*Gypsophila thymifolia*).

Misapplied name: *Gypsophila thymifolia* Halácsy, Beitr. Fl. Thessal. p. 9. in Ver. Brünn.: 85 (1896), non Sibth. et Sm.

Plate XIX, Fig. 18–25. p. 165

Caudex thick woody; stems several thin, hirsute with shorter and softer hairs between, branched, 10–30 cm high, with 1–2 cm long internodes; leaves linear-oblongate, small, 5–12 mm long and 0.5–1 mm wide, hirsute, acuminate, fleshy; inflorescence lax, dichasial; pedicel as long as the calyx; calyx 5–5.5 mm long, 1 mm in diam., hirsute on the ribs with much shorter and softer hairs between; petals white; ovules circa 28; seeds 0.8 mm long, 0.5 mm broad and 0.3 mm thick, with acute tubercles. Fl. Jun.–Jul.; fr. Jul.–Aug.

On rocks.

Type: Greece: Thessaly, near Vólos, Aucher-Eloy 566. Holotype (P), isotypes (FI, P).

Geographic distribution: GREECE: Thessaly (endemic).



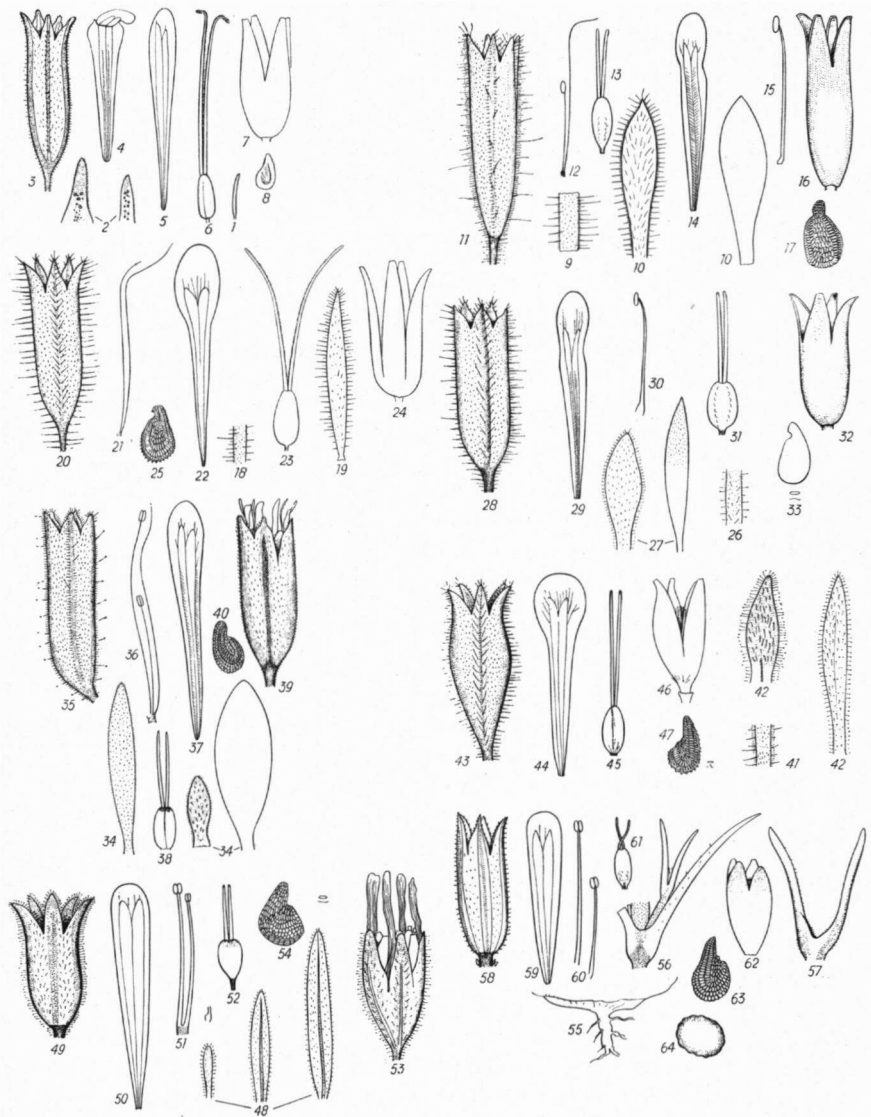


Plate XIX. Fig. 1-8: *B. laconicus*; 1: leaf; 2: bracts; 3: calyx; 4-5: petal; 6: ovary; 7: capsule; 8: seed. Fig. 9-17: *B. fruticosus*; 9: a piece of a stem; 10: leaf; 11: calyx; 12: petal and a stamen; 13: ovary; 14: petal; 15: stamen; 16: capsule; 17: seed. Fig. 18-25: *B. thessalus*; 18: a piece of a stem; 19: leaf; 20: calyx; 21: petal and a stamen; 22: petal; 23: ovary; 24 capsule 25: seed. Fig. 26-33: *B. graecus* var. *graecus*; 26: a piece of a stem; 27: leaves; 28: calyx; 29: petal; 30: stamen; 31: ovary; 32: capsule; 33: seed and a tubercle. Fig. 34-40: *B. filicaulis* var. *filicaulis*; 34: leaves; 35: calyx; 36: petal and two stamens; 37: petal; 38: ovary; 39: capsule; 40: seed. Fig. 41-47: *B. hirsutus* var. *hirsutus*; 41: a piece of a stem; 42: leaf; 43: calyx; 44: petal; 45: ovary; 46: capsule; 47: seed and a tubercle. Fig. 48-54: *B. frankenioides* var. *frankenioides*; 48: leaves; 49: calyx; 50: petal; 51: stamens; 52: ovary; 53: capsyle; 54: seed and a tubercle. Fig. 55-64: *B. cherlerioides*; 55: caudex; 56: node of a stem with one leaf; 57: two leaves; 58: calyx; 59: petal; 60: stamens; 61: ovary; 62: capsule; 63: seed; 64: calcium-oxalate crystal

Thessaly: Mt. Pílion, near Vólos, Orphanides 932 (G-Boiss., JE); *ibid.*, E. de Halácsy s.n. 22 Jul. 1893 a. (JE).

4. *B. graecus* (Schreber) Barkoudah n. comb.

*Lychnis graeca pumila umbellifera* . . . Tournef., Cor. 24.

Basionym: *Saponaria graeca* Schreber, Nov. Act. Nat. Cur. 4: 138, tab. 5. fig. 2 (1770).

Homotypic synonym: *Gypsophila graeca* (Schreber) Britten, Jour. Bot. 345 (1906).

Heterotypic synonyms: *Cucubalus polygonoides* Willd., Sp. Pl. 2, (i): 690 (1799); *Silene polygonoides* (Willd.) Poir. ex DC., Prod. 1: 383 (1824); *Saponaria polygonoides* (Willd.) Jaub. et Sp., Illustr. Pl. Or. 5: tab. 402 (1853-57); *Gypsophila polygonoides* (Willd.) Halácsy, Denks. Akad. Wiss. Wien Math.-Nat. 61: 473 (1894); Halácsy, Consp. Fl. Graec. 1: 191 (1900) p.p. Type: Greece: Náxos, W. Wierweg 1 (B-Willd.)! *Gypsophila ocellata* Sibth. et Sm., Fl. Graec. Prod. 1: 281 (1806) et Icon. Fl. Graec. t. 387 (1806); DC., Prod. 1: 352 (1824); *Saponaria thymifolia* (Sibth. et Sm.) Boiss. var. *ocellata* (Sibth. et Sm.) Boiss., Diagn. ser. 1, (i): 17 (1842); *Gypsophila hirsuta* (Labill.) Spreng. var. *ocellata* Boiss., Fl. Or. 1: 556 (1867); *Gypsophila polygonoides* (Willd.) Halácsy ssp. *ocellata* (Sibth. et Sm.) Hayek, Fl. Balc. 1: 220 (1927). Type: Sibthorp et Smith, Icon. Fl. Graec. tab. 387 (1806)!

Plate XIX, Fig. 26-33. p. 165

Caudex thick woody; stems several, 5-25 cm high, pubescent with rather long glandular or eglandular hairs; leaves lanceolate, small, 5-10 mm long and 1.5-2 mm wide, puberulent; inflorescence capituliform with 5-20 fls.; pedicel mostly shorter but sometimes as long as or longer than the calyx; calyx 5-6 mm long, puberulent but with long hairs on the ribs; petals with a purple cross stripe; ovules circa 20; seeds 1 mm long, 0.5 mm broad and 0.3 mm thick. Fl. Jun.-Jul.; fr. Jul.-Aug.

On rocks and stony slopes, up to 1000 m.

a. var. *graecus*.

Stems 5-15 cm high; inflorescence capituliform with 5-9 fls.; pedicel shorter than the calyx or absent.

Type: specimen: Nov. Act. Nat. Cur. IV (1770) t. V. fig. 2.

Geographic distribution: Greece: Thessaly, Central Greece, Évvoia, Náxos, Peloponnesus, Kíthira.

Thessaly: near Kalambáka, Sint 3801 and 1225 (M); above Trínavos, Haussknecht s.n. 1885 (BR, P); above Kalambáka, Haussknecht s.n. (BR, P). Central Greece: Mt. Hymittos, E. Athinai, Heldreich 488 (JE, L, P); Mt. Párnis, near Tatóion, Heldreich 488 (FI, P); *ibid.*, A. Latourneux 332 (FI, P); Mt. Pateras, Heldreich Fl. Hell. s.n. 1876 (FI). Évvoia: Mt. Dhírfis, Heldreich s.n. 1848 (FI, JE); *ibid.*, Aucher-Eloy 567 (P); above Steni, K. H. Reehinger 19199 (W). Náxos, Despiaux (FI); *ibid.*, Olivier & Bruguière s.n. (P). Peloponnesus: near Kórinthos, Grimburg 424 (G-Boiss.); Mt. Taíyvetos, Pichler s.n. 1876 (FI, P); *ibid.*, K. Fraas s.n. (M). Kíthira: Heldreich 1726 (BR, FI, P).

b. var. *thymifolius* (Sibth. et Sm.) Barkoudah n. comb.

Basionym: *Gypsophila thymifolia* Sibth. et Sm., Fl. Graec. 4: 79, tab. 388 (1806); DC., Prod. 1: 351 (1824).

Homotypic synonym: *Saponaria thymifolia* (Sibth. et Sm.) Boiss., Diagn. ser. 1, (i): 17 (1842), quoad typum; *Gypsophila hirsuta* (Labill.) Spreng. var. *thymifolia* (Sibth. et Sm.) Boiss., Fl. Or. 1: 556 (1867), quoad typum; *Gypsophila polygonoides* (Willd.) Halácsy var. *thymifolia* (Sibth. et Sm.) Halácsy, Fl. Graec. 1: 191 (1900); *Gypsophila polygonoides* (Willd.) Halácsy ssp. *thymifolia* Hayek, Fl. Balc. 1: 220 (1927).

Stem 10–25 cm high; pedicel as long as the calyx or slightly longer; inflorescence lax.

Type: Sibth. & Sm., Fl. Graec. IV (1806) tab. 388. Topotype: Greece: Mt. Parnassós near Delphi, Bornmüller 189 (JE).

Geographic distribution: Greece: Central Greece, Parnassós, Évvoia. Central Greece: Mégara, St. Lager s.n. 1896 (L). Évvoia: between Limni and Strophylia, K. H. Rechinger 16543 (M).

5. *B. filicaulis* (Boiss.) Barkoudah n. comb.

Basionym: *Saponaria filicaulis* Boiss., Diagn. 1, (viii): 72 (1849).

Homotypic synonym: *Gypsophila filicaulis* (Boiss.) Bornm., Beih. Bot. Centralbl. 31, 2: 191 (1914); *Gypsophila hirsuta* (Labill.) Spreng. var. *filicaulis* Boiss., Fl. Or. 1: 557 (1867); Post, Fl. Syr. ed. 2. 1: 168 (1932).

Plate XIX, Fig. 34–40. p. 165

Caudex thick, woody; stems several, 10–30 cm high, puberulent to pubescent, erect, branching in the upper part; leaves linear-oblong, 7–13 mm long and 1.5–3 mm wide, rounded or obtuse at the apex, narrowed at base, glabrous to pubescent, fleshy; inflorescence dichasial; pedicel mostly shorter than the calyx, but sometimes up to 7 mm long; calyx 4.0–5.5 mm long and 1.5 mm in diam., pubescent with rather long glandular hairs; ovules circa 24; seeds 0.8 mm long, 0.5 mm broad and 0.3 mm thick. Fl. May–Jun.; fr. Jun.–Jul.

On calcareous rocks and on arid soil, up to 1000 m.

a. var. *filicaulis*

Stems puberulent, glaucous; leaves pubescent.

Type: Syria: near Damascus, Boissier s.n. 1846. Holotype (G-Boiss.), isotype (P).

Geographic distribution: Syria, Lebanon and Jordan.

SYRIA: Mt. Qasioune, near Damascus, Gaillardot n. 1649 (P); *ibid.*, Bornmüller n. 11464 (E, BM, JE); between Damascus and Palmyra, Kotschy n. 476 (P); Dommarr, near Damascus, Gaillardot n. 1649 (JE); around Damascus, Zohary n. 13517 and n. 13516 (HUJ); 78 km W. of Soukhne, Eig and Zohary n. 13515 (HUJ); Kefer Haouar, 35 km S. E. Damascus, Berton 460 (P); Salihié, Damascus, E. Peyron n. 69924 (P); Ain el Fijj, Barada valley, E. Peyron n. 55080 (P); Syria, Aucher n. 626 (FI); Ain el Fijj, Barada valley, A. Lecesuny in herb. Marchesetti (FI). JORDAN: Amman, Eig, Zohary and Feinbrun n. 13518 and n. 13520 (HUJ); Ein Suella to Es-Salt, Eig and Zohary n. 13519 (HUJ); Gebel Siaghah, E. of Jordan river, J. A. Pain 1873 (G-Boiss.).

b. var. *ansariensis* (Reching.) Barkoudah n. comb.

Basionym: *Gypsophila polygonoides* ssp. *ansariensis* Reching. f. in Ark. f. Bot. 5 (i): 118 (1960).

Stem puberulent and purplish; leaves more or less glabrous.

Type: Syria: Mt. Nusairy: Ain-Halakeni, Haradjian 13518 (W).

LEBANON: Tripoli, Yacoub lake, Blanche 47931 (P).

6. *B. hirsutus* (Labill.) Barkoudah n. comb.

Basionym: *Saponaria hirsuta* Labill., Dec. Syr. 4: 9, t. 4 fig. 2 (1812).

Homotypic synonym: *Gypsophila hirsuta* (Labill.) Spreng., Syst. 2: 373 (1826).

Heterotypic synonym: *Saponaria mollis* Boiss., Diagn. ser. 1, (viii): 72 (1849); *Gypsophila hirsuta* (Labill.) Spreng. var. *mollis* (Boiss.) Boiss., Fl. Or. 1: 556 (1867); *Gypsophila mollis* (Boiss.) Bornmüller, Beih. Bot. Centralbl. 31, 2: 191 (1914); Post, Fl. Syr. 1: (1932). Type: Lebanon: near Ehden, Boissier s.n. 1846 (G-Boiss.).

Plate XIX, Fig. 41–47. p. 165

Caudex thick woody; stems several erect, 5–20 cm high, minutely glandular-pubescent, with or without some longer hairs; leaves elliptic, small, circa 1 cm long and 2 mm wide, acute, slightly fleshy, glandular-pubescent; inflorescences terminal and axillary, dense or lax; pedicel shorter to slightly longer than the calyx; calyx 3–5 mm long, slightly urceolate, puberulent, with or without longer hairs on the ribs; petals white; ovules circa 20; seeds 1 mm long, 0.5 mm broad and 0.3 mm thick, with acute tubercles. Fl. Jun.–Jul.; fr. Jul.–Aug.

In fissures of calcareous rock, on hills and mountains.

a. var. *hirsutus*

Stems 8–20 cm high, glandular-pubescent with some longer hairs; inflorescences dense, terminal and axillary; pedicel shorter than the calyx; calyx 4–5 mm long, puberulent with longer hairs on the ribs.

Type: Syria, without exact locality, Labillardière (FI).

Geographic distribution: High mountains of Syria, Lebanon and Palestine.

SYRIA: Pinard s.n. 1846 (M); *ibid.*, Maire s.n. (P); Tell, Kotschy s.n. 1855 (BM); west of Duma, Post s.n. 1855 (E). LEBANON: near Bsherry, Zerny s.n. 1931 (W); *ibid.*, and around the Cedrus forest above Ehden, Kotschy 339 (P, BM); *ibid.*, Ehrenberg s.n. (M); *ibid.*, Mar Sarkis, Blanche 2970 (JE, P); near Ehden, Blanche 2972 (JE, P); between Cherbine and Hermel, Bot. Dep. s.n. 1934 (HUJ); Dhahr el Kadib, Post 867 (BM).

b. var. *alpinus* (Boiss.) Barkoudah n. comb.

Basionym: *Gypsophila hirsuta* (Labill.) Spreng. var. *alpina* Boiss., Fl. Or. 1: 557 (1867); Post, Fl. Syr. 1: 188 (1932); Blatter, Fl. Arab. 59 (1919).

Stem 5–8 cm high, glandular-pubescent without longer hairs; inflorescence dense; calyx 3–4 mm long, without long hairs on the ribs.

Type: Syria: Mt. Hermon, Boissier s.n. 1846 (P); paratypes: *ibid.*,

Kotschy 248 (BM, P); Jordan: Arabian Petra, Mt. Catharina, Schimper 276 (BM, FI, L, P).

SYRIA: Mt. Hermon, Eig 13513 and 13514 (HUI); without exact locality, Aucher 626 (P). LEBANON: Mt. Makmel, Post s.n. 1898 (BM); above Ehden, Eig and Zohary 13512 (HUI); Mt. Matrafah, Stud. Rer. Nat. 13510 (HUI).

c. var. *barradensis* (Boiss.) Barkoudah n. comb.

Basionym: *Saponaria barradensis* Boiss., Diagn. ser. 1, (viii): 72 (1849).

Homotypic synonym: *Gypsophila hirsuta* (Labill.) Spreng. var. *barradensis* (Boiss.) Boiss., Fl. Or. 1: 557 (1867).

Stems 10–15 cm high, puberulent without longer hairs; inflorescences lax; pedicel as long as or slightly longer than the calyx; calyx 4–5 mm long, puberulent without longer hairs on the ribs.

Type: Syria: Souk Wadi Barada, Boissier s.n. (G-Boiss.).

7. *B. frankenioides* (Boiss.) Barkoudah n. comb.

Basionym: *Gypsophila frankenioides* Boiss., Diagn. ser. 1, (i): 10 (1842); id., Fl. Or. 1: 555 (1867); Post, Fl. Syr. 1: 167 (1932).

Plate XIX, Fig. 48–54. p. 165

Stems prostrate, tufted, 1–5 cm long, sparsely or densely covered with glandular hairs, sometimes viscous, branched throughout; internodes circ. 1 cm long; leaves linear-aciculate, circ. 5 mm long and 1 mm wide, with thick costa, slightly fleshy, sparsely glandular-hairy, with tufts of leaves or short shoots in the axil; either with dichasial, dense or lax inflorescences, or with the flowers solitary in the axils of the leaves; pedicel about as long as the calyx; calyx tubiform-campanulate, 3–3.5 mm long, 1 mm wide, with some hairs on the teeth and the ribs, the teeth ovate and acute to obtuse; petals linear-cuneate, with rounded apex, pink; ovules circ. 20; seeds 1 mm long, 0.5 mm broad and 0.5 mm thick, with small tubercles. Fl. Jul.–Aug., fr. Aug.–Sept.

On stony slopes, 1500–2500 m.

Type: Syria: Mt. Qadmous, above Colossam?, Boissier s.n. Holotype (G-Boiss.), isotype (P).

a. var. *frankenioides*.

Stems sparsely covered with glandular hairs; flowers mostly solitary in the axils of the leaves; pedicel as long as the calyx.

Type: The same as that mentioned under the species. Only known from the type collection.

b. var. *libanoticus* (Boiss.) Barkoudah n. comb.

Basionym: *Gypsophila frankenioides* Boiss. var. *libanotica* Boiss., Fl. Or. 1: 555 (1867); Post, Fl. Syr. 1: 167 (1932).

Stems densely glandular-pubescent, viscous; inflorescence dichasial, lax; pedicel often longer than the calyx.

Type: Lebanon: Diman to Yammouny, Blanche 2974. Holotype (G-Boiss.), isotype (JE).

LEBANON: Tripoli, Cedrus forest, Blanche s.n. 1878 (G); ibid., A. Kelousny s.n. 1884 (P); Kornet es-Souda, Zohary and Eig 13505 (HUI); without exact locality, Post (BM); between the Cedrus forest and Baalbek, Kotschy 351 (K).

c. var. *fasciculatus* (Boiss. & Heldr.) Barkoudah n. comb.

Basionym: *Gypsophila frankenioides* var. *fasciculata* Boiss. & Heldr., Diagn. Ser. 1, (viii): 58 (1849).

Less hairy than the type var.; inflorescence denser; pedicel shorter than the calyx; petals purple-rosy.

Type: TURKEY: Wilayet Antalya, Mt. Davros-dagh, Heldreich s.n. 1895, isotype (FI).

8. *B. cherlerioides* (Bornm.) Barkoudah n. comb.

Basionym: *Gypsophila cherlerioides* Bornm., Mitteil. Thüring. Bot. Ver. 23: 2 (1908).

Plate XIX, Fig. 55-64, p. 165

Cushion-shaped; thin but woody branched caudex; stems several, less than 5 cm high, much branched, puberulent; internodes less than 5 mm long; leaves subulate, circ. 5 mm long, terete, acute, scarious and connate at base, more or less glandular-ciliate there, with tufts of leaves or short shoots in their axil; inflorescence terminal, 1- to 3-flowered; flowers sessile; calyx tubiform-turbinata, 3-4 mm long and 1-1.5 mm in diam., sparsely glandular-hairy, teeth triangular, acute, about one third of the whole length of the calyx, glandular-ciliate; petals linear-cuneate, with rounded or truncate apex; ovules 8. F. Jun.-Jul.

Alpine zone, 1500-2000 m.

Type: Turkey: Prov. Konya, Sultandagh, above Akseher, J. Bornmüller 4399, isotype (M), holotype (B, destroyed).

TURKEY: Wilayet Mugla, Sandras Dagh, between Gokcena and the mount., P. H. Davis 13502 (E).

### ANKYROPETALUM

*Ankyropetalum* Fenzl, Bot. Zeit. 1843: 393 (1843); Boiss., Fl. Or. 1: 532 (1867); *Gypsophila* L. sect. *Ankyropetalum* (Fenzl) Benth., Gen. Pl. 1. i: 146 (1862); Williams, Jour. Bot. 27: 322 (1889); *Gypsophila* L. subg. *Ankyropetalum* (Fenzl) Benth. ex Stroh, Beih. Bot. Centralbl. 59, B: 393 (1939).

Calyx not preceded by bracteoles, tubiform, 5-ribbed, the ribs alternating with hyaline intervals; teeth small; receptacle thick; petals 5, with long linear claw and deeply incised limb; stamens 10, long-exserted; ovary ovoid, sessile, with two long spreading styles; stamens small, terminal; ovules 8-10, implanted on a short, basal placenta, and provided with long funicles; capsule ovoid, dehiscing from the base by longitudinal slits; seeds 1-3, reniform-globose, with marginal hilum, covered with wartlets; embryo peripheral; endosperm central.

Perennial rigid plants with lax dichasial inflorescences; leaves linear, mostly caducous; bracts triangular, membranous.

Type species: *Ankyropetalum gypsophiloides* Fenzl.

Geographically this genus extends from West Iran, over North Iraq, South Turkey, Syria and Lebanon, to Mt. Sinai S. of Palestine. Its area, therefore, forms a semi-circle round the Syrian Desert. It is

one of the endemic genera of the area which was described by EIG (1931) as the Mesopotamian subregion. It grows on dry hills, mostly on calcareous soil. In the mountains it may reach an altitude of 1500 m, but it is always confined to dry exposed parts. The chamaephytic character of these plants may be regarded as an adaptation to the dry hot summer which is characteristic for this area. The small caducous leaves help in reducing the transpiring surface of the plant.

#### 1. DELIMITATION OF THE GENUS AND DISCUSSION OF THE LITERATURE

This small genus of the *Silenoideae* was described by Fenzl and subsequently became an object of controversy, some authors considering it to be a separate genus, others putting it in *Gypsophila*. BENTHAM (1862) says: "Among the small genera proposed by various authors which we do not consider sufficiently distinct to adopt . . . , *Ankyropetalum* Fenzl (is) chiefly distinguished by the rigid habit and small narrow calyx, which bring it very near to the small-flowered *Saponaria*." In BENTHAM and HOOKER, Gen. Pl. I (1862) *Ankyropetalum* was put by him in *Gypsophila* as a separate section. BOISSIER, on the other hand (1867), agreed with Fenzl on the desirability of maintaining *Ankyropetalum* as a separate genus, and said: "Herbae perennes subaphyllae intricatim ramosissimae facie *Gypsophilae rokejekae*. Genus *Saponariae* et *Gypsophilae* valde affine, ab utrâque tamen sat naturaliter formâ petalorum, capsulâ irregulariter dehiscenti et seminibus sero deciduis sejunctum." On account of the fact that three-lobed petals are found also in *Gypsophila hispida* Boiss., WILLIAMS (1889) proposed to reduce the genus *Ankyropetalum* to a subgenus of *Gypsophila*. PAX and HOFFMANN (1934) and STROH (1939) also considered *Ankyropetalum* to be a subgenus of *Gypsophila*. In the various floras of Syria, Lebanon and Iraq, the authors adopt one of the last-mentioned opinions.

The *Gypsophila* species which shows the greatest resemblance to *Ankyropetalum* is *Gypsophila arabica* Bark. (formerly included in *G. capillaris* (Forsk.) Christ. = *G. rokejeka* Del. as interpreted by earlier authors). Though this species resembles *Ankyropetalum* in its rigid habit and small linear leaves, the latter differs conspicuously from it and from all or most other *Gypsophila* species in the following points:

1) In *Ankyropetalum* the calyx is merely toothed, not more deeply divided, that is to say the length of the lobes is at the most one fourth of the total length of the calyx. In *Gypsophila* this character is present only in the subgen. *Pseudosaponaria*, which is quite different from *Ankyropetalum* in its other characters.

2) In *Ankyropetalum* the calyx is campanulate-tubular, not turbinate as it is in all *Gypsophila* species. The calyx in *Ankyropetalum* moreover springs from a swollen receptacle which carries the floral parts, and such a swollen receptacle is not found in any *Gypsophila* species.

3) A gynophore is not developed in *Ankyropetalum*, and the ovary is therefore more or less sessile, and this is not so in any *Gypsophila* species.

4) In *Ankyropetalum* the petals have an incised limb, and every lobe may be divided again, and this is never so in *Gypsophila*. The three-lobed petals of *Gypsophila hispida*, on account of which Williams included *Ankyropetalum* in *Gypsophila*, are in no way comparable to the petals of *Ankyropetalum*, for they are but very shallowly lobed and may perhaps better be described as sinuous.

5) In *Ankyropetalum* the stamens are long-exserted and spreading, and the filaments are filiform and long, and this is never so in *Gypsophila*.

6) In *Ankyropetalum* the placenta is very short and confined to the basal part of the ovary, and the ovules are provided with long funicles, and this is never so in *Gypsophila*.

7) In *Ankyropetalum* the mature capsule is always enveloped by the dry calyx, and it bursts at the base with irregular longitudinal cracks; afterwards the calyx and the capsule wall disappear, the seeds remaining attached to the dry receptacle, and this is never so in any *Gypsophila* species.

8) In *Ankyropetalum* the seeds are more or less globose, not compressed, and the radicle is not prominent as it is in *Gypsophila*.

9) The root of *Ankyropetalum gypsophilooides* is similar to that of *Acanthophyllum* showing the anatomical abnormality mentioned on p. 7.

For all these reasons, I believe that Fenzl was quite right in referring his plant to a separate genus.

On the other hand, though *Ankyropetalum* is, as BENTHAM (1862) pointed out, similar to small-flowered *Saponaria* species, it differs from that genus in the following points:

1) in its rigid habit, and small early deciduous leaves; characters which are never found in *Saponaria*,

2) in the rich inflorescence with the long pedicels and small hyaline bracts,

3) in the broad hyaline intervals between the green parts of the calyx,

4) in the form of the petals,

5) in the terminal stigma,

6) in the absence of an androphore and a gynophore,

7) in the mode of dehiscence of the capsule, and in the way in which the seeds are attached.

Furthermore, I am convinced that *Ankyropetalum* can not be confused with any other genus of the *Silenoideae*, and that its independence is therefore fully assured.

## 2. KEY TO THE SPECIES

1. Plants almost unbranched, glabrous or with very few hairs; calyx 3–5 mm long, glabrous; petal claw hirsute ..... 3. *A. arsiusianum* Kotschy

Plants branched, distinctly glandular-hairy, especially in the upper part of the plant and on the calyx .....

2. Pedicel 1 cm long or less; petal claw and filaments papillose; calyx teeth and the central lobe of the petal erose 2. *A. reuteri* Boiss. et Hauss Kn.



Pedice! 1-2 cm long; petal claw and filaments not papillose, calyx teeth and the central lobe of the petal entire . . . 1. *A. gypsophiloides* Fenzl.

### 3. SPECIES DESCRIPTIONS

1. *Ankyropetalum gypsophiloides* Fenzl, Bot. Zeit. 1843: 393 (1843); Boiss., Fl. Or. 1: 533 (1867); Post, Fl. Syr. Pal. and Sin. 2nd ed. 1: 164 (1932).

Homotypic synonym: *Gypsophila gypsophiloides* (Fenzl) Blakelock, Kew Bull. 1957: 193 (1957).

Heterotypic synonyms: *Ankyropetalum gypsophiloides* Fenzl var. *glandulosum* Bornmüller, Beih. Bot. Centralbl. 28 (2): 136 (1911). Type: Iraq: Rawandus, Mt. Handarin, Bornmüller 953 (JE)! *Gypsophila subaphylla* Rechinger f., Bot. Jahrb. 75: 355 (1952). Type: Iran: Luristan, Bisheh, 50 km east of Khorramabad, Rechinger 5770 (W, K)!

Plate XVIII, Fig. 18-28. p. 158

Caudex thick, woody; stems several, erect, grey-green, 50-80 cm high, branching throughout, glandular-hairy in the upper part, sometimes viscous by sessile glands; leaves linear, 2-4 cm long, 1-2 mm wide, obtuse, narrowed at base, caducous; pedicel capillary, 1-2 cm long, glandular-hairy; calyx tubiform, 4-5 mm long, glandular-hairy, with small ovate teeth; petal limb 5-lobed, the middle lobe entire, deltoid; capsule enveloped by the dry calyx, with 2 seeds; seeds reniform-globose, with echinate wartlets, in cross-section 2 mm  $\times$  0.8 mm. Fl. Jun.-Jul., fr. Jul.-Sept.

On dry hills, river banks and shallow soil, and on calcareous rocks, 700-1400 m.

Type: Turkey, between Mardin and Zakho, Assouer and Salago, Kotschy 356 (G-Boiss.)!

The density of the indumentum is seen to increase in the representatives of this species when we pass from the western part of its geographic area to the east. The plants growing in the Antilebanon and in Palestine are less hairy than those growing in Iraq and Iran, but all intermediate grades of hairiness are present. Some plants in the west have petals with a three-lobed instead of five-lobed limb, but in the same locality plants with 5-lobed petals are found. Whether these two forms do interbreed or not, I am unable to say. At the same time I am not sure whether this character is constant or not. However, it can not be doubted that according to the composition of the indumentum three varieties can be distinguished:

a. Var. *gypsophiloides*: Plants not viscous; basal part of the stem glabrous, upper part thickly glandular-hairy.

Type: The same as that mentioned under the species.

IRAN: Prov. Luristan (K, W); Gaomis, Bakhtiari, W. Koelz 15454 (W); between Saqez and Miadoab, Rechinger 14759 (W); Fars, Tal'Khosrow to Sissakht, Behhoudi 1095 (M); Malamir, Haussknecht s.n. Aug. 1868 (G-B, JE, M); between Sahne and Kermanshah, Haussknecht 187a (JE, P); Mt. Ovrāmān and Sahn, Haussknecht 186 (B-B, JE, P). IRAQ: Between Kirkuk and Sulaimaniya, Rechinger 10065 (W); Mt.

Hamrin, Sutherland 563 (M, W); Irbil, Gillett 9637 (BAG, K); Mesopotamia, Aucher 552 (FI, GB); Mesopotamia, Kotschy 356 (E); between Surdash and Shadala, Zohary and Feinbrun 13753 (HUJ); Surchinar Bakaraji near Sulaimaniya, Eig and Feinbrun 13760 (HUJ); between Irbil and Kirkuk, Haussknecht s.n. 1867 (G-B, JE); near Zākhū, Rechinger 10694 (W); distr. Diyala, near Mandali, Rechinger 9695 (W); Sulaimaniya, near Tawilla, Rechinger 12394, sterile (W); near Rāwānduz, Rechinger 11238, fr. (W); Irbil, Mt. Malmour Dag, Gillett 11248 (BAG); Altū Küpri on Zab river, E. R. Guest 4022 (BAG); between Kirkuk and Derbent-i-Basion, Haussknecht s.n. 1867 (JE). TURKEY: Kurdistan, near Kara, Kotschy 406 (FI, G-B, M); Mardin, Sint 1157 (BR, E, K, W); Aintab, Haussknecht 844 (JE); near Arablār, between Aintab and Maras, Haussknecht 1865 (G-B, JE).

b. *Var. viscosum* Bark. var. nov.: Plantae glanduloso-pubescentes, in internodiis superioribus glandulis sessilibus viscosae. On calcareous rocks. Holotype: Iraq, between Rawanduz and Bersorin, distr. Irbil., Rechinger 11268 (W).

c. *Var. coelesyriacum* (Boiss.) Bark. comb. nov.

Homotypic synonyms: *Ankyropetalum coelesyriacum* Boiss., Diagn. Ser. 1, (VIII): 59 (1849); id., Fl. Or. 1: 534 (1867); Post, Fl. Syr. 1: 164 (1932); *Gypsophila coelesyriaca* (Boiss.) Williams, Jour. Bot. 27: 322 (1889). Plants not viscosus; basal part of the stem puberulent, upper part glandular-pubescent.

Type: Lebanon, Bekaa, Boissier s.n. 1846. Holotype (G-B), isotypes (E, G, P).

Geographic distribution: Lebanon, Syria, Palestine.

LEBANON: Baalbek plain, Blanche s.n., 6 VII 1867 (JE); Kephra Ammin, Post s.n., 29 VI 1888 (JE); Hamarra, Goumbault 1850 (P). SYRIA: Yabroud, Davis 9974 (E); near Damascus, on the way to Beirut, Dingler s.n. 1874 (B); near Zebdani, Kotschy s.n., 17 VI 1855 (G-B); Kephra Haouar and Helwi, Berton 399 (P); Mt. near Damascus. Bové s.n. (P); Damascus to Hamé, Cotte 573 (L); between Soran and Morek, Eig and Zohary 13755 (HUJ). Sinai, Aucher 541 (FI), *ibid.*, G. De Montbret s.n. (FI); Tell-el-kadi, N. E. Safad, and in Yavne'el, Hulah, Eig (1926).

2. *Ankyropetalum reuteri* Boissier et Haussknecht, Fl. Or. 1: 533 (1867); Post, Fl. Syr. 2nd ed. 1: 164 (1932); Homotypic synonym: *Gypsophila reuteri* (Boiss. et Hausskn.) Williams, Jour. Bot. 27: 322 (1889); Stroh, Beih. Bot. Centralbl. 59 B: 466 (1939).

Plate XVIII, Fig. 29-34. p. 158

Caudex thick and woody; stems several, upright, grey-green, glabrous, branching throughout, 20-40 cm high; leaves linear, 1-2 cm long and 1 mm wide, acuminate, narrowed at base, for 1-2 mm connate around the stem, more or less fleshy; inflorescence dichasial, twice compound, with very short primary branches, the flowers therefore semi-umbellate, glandular-hairy; pedicel ca. 1 cm long, glandular-hairy, capillary; calyx tubiform, 4-5 mm long, with ovate, erose teeth; petals with a long papillose claw and deeply incised trilobed limb, the middle lobe deltoid with erose margin; stamens long-exserted, with papillose filaments; capsule with 1-2 seeds; seeds reniform, globose, with acute wartlets, 1.5 mm in diam. Fl. Jul.; fr. Aug.-Sept.

On rocks, alt. ca. 1500 m.

Holotype: Turkey, Maras, Bakkerdagh, Haussknecht 15 VII 1861 (JE).

Hort. Genev. ex seminibus persicis a cl. Haussknecht lectis, Reuter (G-B).

POST (1932) reports this species from Palestine, Huleh collected by Eig.

3. *Ankyropetalum arsusianum* Kotschy ex Boiss., Fl. Or. 1: 533 (1867);

Homotypic synonym: *Gypsophila arsusiana* (Kotschy) Williams, Jour. Bot. 27: 322 (1889); Stroh, Beih. Bot. Centralbl. 59. B: 466 (1939); Post, Fl. Syr. 2nd. ed. 1: 164 (1932).

Plate XVIII, Fig. 35-39. p. 158

Caudex thick, woody; stems several, fading green, unbranched or a few times branched, glabrous, 50-70 cm high; leaves linear, 5-15 mm long, 1-3 mm wide, obtuse, narrowed at base; inflorescence dichasial, pseudo-corymbose; bracts triangular, acuminate, small; pedicel capillary, ca. 1 cm long; calyx 3-4 mm long, 2 mm diam., with a few hairs, lobes ovate, acute; petals with linear hirsute claw and deeply incised trilobed limb, every lobe bifid; stamens long-exserted and spreading; seeds with blunt wartlets. Fl. Jun.-Jul.; fr. Jul.-Aug.

On rocky soil up to 1000 m.

Isotypes: Turkey, Mount. Amanus, near Arsus, Kotschy 117 (L, JE).

## PHRYNA

### A CRITICAL MONOTYPIC GENUS OF THE *Silenoideae*

Among the material I received on loan when preparing my revision of the genus *Gypsophila* were sufficient examples of the species which Boissier in his *Flora Orientalis* mentioned under the name "*Gypsophila ortegioides* Boiss." This gave me an opportunity to study this species thoroughly in its flowering as well as in its fruiting stages and to determine its systematic position. On the latter in the course of time very different opinions were held, for it was originally described in *Tunica*, then moved from there first to *Saponaria*, subsequently to *Gypsophila* and at last to a genus of its own.

The first example of this species was studied by FISCHER and MEYER and described under the name *Tunica ortegioides* F. et M. (1854). That specimen was a poor flowering one which had been collected by Tchihatcheff in Turkey. Later, BOISSIER (1859) studied the type specimen and also another specimen collected by Balansa and decided that this species had to be shifted to *Saponaria*. In doing this, Boissier corrected the spelling of the specific epithet, making it "ortegioides". Tchihatcheff (1860) published a drawing of this species under the name *Saponaria ortegioides* Boiss. In *Flora Orientalis*, Boissier retained his spelling of the specific epithet, but shifted the species to *Gypsophila*, making it the type of a special section, viz. "*Phryna*". WILLIAMS (1889) excluded the section *Phryna* from *Gypsophila* and suggested either to add it to *Tunica* or to make

a separate genus of it. PAX and HOFFMANN (1934) actually raised this section to generic rank so that it became *Phryna* (Boiss.) Pax and Hoffm.

I agree with Pax and Hoffmann that this species is unique in its set of characters and sufficiently distinct from all other *Silenoideae* to be regarded as representing a separate genus. What I will try to do here is to emend the generic and specific diagnoses and to discuss the relations between this genus and the neighbouring genera.

### 1. DIAGNOSIS

*PHRYNA* Pax and Hoffm. in Engler and Prantl, Nat. Pflanzenfam. ed. 2. 16 C: 351 (1934); *Gypsophila* sect. *Phryna* Boiss., Fl. Or. 1: 552 (1867).

Flower preceded by 1–3 pairs of bracteoles which form a sort of involucre; calyx long-campanulate, up to about one third divided in teeth, 5-costate, the ribs alternating with hyaline intervals, petals cuneate, with a bare claw and without corona; stamens included; ovary with several ovules and with styles which are stigmatose all along the inner side; capsule long-ovoid, opening with 4 fissures extending to the middle, with 1–3 seeds; seeds oblong, comma-shaped, with a marginal hilum; embryo hook-shaped, with a straight prominent radicle.

Perennial herb with woody caudex, rigid stem, linear leaves, in habit similar to *Tunica*, but with the dichasial inflorescence very often reduced to solitary sessile flowers.

*Phryna ortegioides* (sphalm. "*artegioides*") (Fisch. & Mey.) Pax et Hoffmann in Engler und Prantl, Nat. Pflanzenfam. ed. 2. 16 C: 351 (1934).

Basionym: *Tunica ortegioides* (sphalm. "*artegioides*") Fisch. & Mey., Ann. Sc. Nat. ser. 4, 1: 36 (1854).

Homotypic synonyms: *Saponaria ortegioides* (Fisch. & Mey.) Boiss. et Balansa, Diagn. Pl. Or. ser. 2, 6: 25 (1859); *Gypsophila ortegioides* (Fisch. & Mey.) Boiss., Fl. Or. 1: 552 (1867); *Tunica xylorrhiza* Boiss., Ann. Sc. Nat. ser. 4, 2: 246 (1854) superfluous name.

Tchihatcheff, Asia Min. Bot. t. 11. (1860); Post, Fl. Syr., Pal. and Sin. I: (1932) 167; Rechinger, Zur Fl. von Syr., Arkiv för Bot., 5: 118 (1959).

Plate XVIII, Fig. 40–49. p. 158

Low shrubby plants, 10–20 cm high, with a woody caudex and several rigid glandular-puberulent forked stems; internodes shorter than 1 cm; leaves linear, up to 1 cm long and up to 1 mm wide, mostly with 3 parallel veins, in the basal part of the plant mostly spreading and in the upper part rigidly erect; flowers axillary and terminal, confined to one side of the node, mostly solitary, sessile, provided with 2–3 pairs of bracteoles at the base; bracts and bracteoles lanceolate, hyaline, acute, glandular-pubescent, always shorter than the calyx; calyx narrowly campanulate, puberulent, glandular in the upper part. 5-costate, with hyaline intervals, incised

to one third, with lanceolate acuminate, mostly incurved, 2.5–3 mm long, 1 mm wide teeth; petals linear-cuneate, entire, tapering at base, without any contraction between the upper and the lower part, white with purplish veins, slightly longer than the calyx, up to 4 mm long and 1 mm wide; stamens included, unequal; ovary ovoid, with 8 ovules arranged in 4 series, styles thick, included, stigmatose all along the inner side; capsule long-ovoid, longer than the calyx, opening to the middle with 4 valves, with 1 or 2 seeds; seeds oblong, comma-shaped, with a straight prominent radicle; embryo hook-shaped. Fl. Aug.; fr. Sept.

Holotype: Coll. M. de Tschihatcheff in Turkey, Ali Dag, near Kayseri, n. 601. (P).

South and Middle Turkey (endemic).

On dry mountains, sandy banks and slopes, and among dwellings, alt. 1000–2200 m.

TURKEY: Ali Dag, 7 km S.E. of Kayseri (Cappadocia) alt. 1450 m, coll. Balansa 1066 (P); Ak Dag, alt. 2000 m, Haussknecht s.n. 1865 (M); Beg Dag above Malatya, and above Adiyaman, alt. 2000 m, and between Adiyaman and Malatya, coll. Haussknecht s.n. Aug.-Sept. 1865 (JE, P); Kabaohtepe near Dschihave, on arid hills, coll. Haussknecht 13 Aug. 1868 (JE); sunny places at the foot of Bergt Dag, coll. Haussknecht 14 Aug. 1868 (JE); Argacus, alt. 2000 m, coll. W. Siehe n. 260, 6 Aug. 1898 (JE); Ali Dag, coll. R. Maire n. 715, 28 Sept. 1904 (JE); Amanos Mts., Kusliji Dag, alt 1700–2200 m, coll. Haradjian n. 435, 1906; n. 1562, Jul. 1907; n. 2491, Aug. 1908, and n. 4585, Aug. 1913 (W); Orgée Mts., alt. 2000 m, coll. Lavoisier 1911 (L); prov. Nevsehir: Göreme, 10 km W. of Urgüp, als 1000 m, coll. McNeill n. 407, 3 Aug. 1956 (E); BORNMÜLLER, J. (1917) reported this sp. from Maras and Alexandretta no. 121.

## 2. TAXONOMIC DISCUSSION

When Fischer and Meyer described this species, they put it in *Tunica*. The same did Boissier when he saw this species for the first time. This is quite explainable when we realize how strongly it resembles a species like *Tunica saxifraga* (L.) Scop. The rigid stem, linear acute parallel-nerved leaves, involucrate and long campanulate calyx, cuneate petals, short stamens, ovoid, several-ovuled ovary, thick and entirely stigmatose styles and narrowly ovoid 4-valved capsules are characters that are found in that species too. However, the comma-shaped instead of peltate seeds, and the hook-shaped instead of straight embryo of *Phryna ortegioides* are characters which are doubtless important enough to exclude this species from *Tunica*.

In order to understand the arguments which in 1859 induced Boissier to insert this species under *Saponaria*, we must compare it with a species like *Saponaria picta* Boiss. We then find that they resemble each other in the presence of glandular hairs, the narrowly campanulate calyx, the ovoid ovary, the stigmatose styles and the narrowly ovoid 4-valved capsule. However, the rigid stems, parallel-nerved leaves, involucrate calyx, the bare claw of the petals, and the comma-shaped seed with its prominent radicle are points of difference of sufficient importance to separate this species from *Saponaria*.

Arguments may also be adduced to include it in *Gypsophila*, as

BOISSIER subsequently did in Fl. Or. I (1867). *Gypsophila tubulosa* Boiss., for example, is similar to this species in its glandular-hairy, rigid stem, narrowly campanulate calyx with hyaline intervals, cuneate petals with bare claw, styles which are along their whole length stigmatose, narrowly ovoid 4-valved capsule, and comma-shaped seeds with prominent radicle. But *Phryna ortegioides* differs from *Gypsophila tubulosa* Boiss. and its nearest allies by its parallel-nerved leaves, the reduction of the inflorescence to a single or to a few flowers, the involucrate calyx and the straight prominent radicle.

This species has also several points in common with *Acanthophyllum minuartioides* (Jaub. et Sp.) Barkoudah. The rigid habit, linear parallel-nerved leaves, sessile axillary and terminal flowers, linear cuneate petals, unequal stamens, stigmatose styles, and the comma-shaped seeds are characters which these two species have in common. But the mostly solitary flowers, involucrate calyces, and long-ovoid deeply 4-valved capsules distinguish *Phryna ortegioides* from *Acanthophyllum minuartioides* and prevent the inclusion of these two species in the same genus.

According to macro-morphological characters this monotypic genus must therefore be regarded as closely related to the above-mentioned four genera. It is most nearly related to *Gypsophila* and *Acanthophyllum*, and less nearly related to *Saponaria* and *Tunica*. The similarity of this genus to *Tunica* may be considered to be a kind of convergence. It is quite possible that this genus originated from "Gypsophiloid" ancestors, which were related in the first place with those of *Acanthophyllum*, in the second place with those of *Saponaria*; these ancestors may have developed later in a direction parallel to that of the genus *Tunica*.

#### SPECIES OF UNCERTAIN STATUS AND NAMES OF UNCERTAIN APPLICATION

*Gypsophila adscendens* Jacquin, Hort. Vindob. 2 (1772) 65, tab. 138. No type specimen, or any other specimen is cited. The drawing shows much similarity to *Gypsophila repens* L.

*Gypsophila ascendens* Medikus, Beobacht. (1783) 165. No type specimen or any other specimen is cited. It is very difficult to know which species Medikus meant in his description.

*Gypsophila carminea* Hort., Gard. Chron. 48 (1910) 66. No type specimen or any other specimen is cited. The description is not complete. Perhaps *Gypsophila elegans* M. Bieb., which is a garden plant, is meant here.

*Gypsophila corymbosa* Rafin. Autikon Bot. (1840) 25. No type specimen or any other specimen is cited. Probably it is a form of *Gypsophila fastigiata* L.

*Gypsophila dshungarica* Czerniakowska, Not. Syst. Harb. Hort. Petrop. 3 (1922) 130. Type specimen: Lipskij, V.I. 204 from China, Kulčzinskij region, basin of the river Borotal, southern Dzungaria, Alatau (LE not seen). It is remarkable that Šiškin, Fl. U.S.S.R. 6 (1936) did not cite this species. Unfortunately, the author could not

see any material of this species. From the description one can conclude that it is related to *Gypsophila patrinii* Ser.

*Gypsophila elata* Wender, Schrift. Ges. Bef. Gesamt. Naturw. Marb. 2 (1831) 251.

*Gypsophila gracilescens* Šiškin, Candollea 3 (1928) 437. Type: Šiškin from Armenia, between Igdyr and Bajazet (TK? not seen). The author saw a photo of the type in (K). This species is perhaps identical with *Gypsophila tenuifolia* M. Bieb.

*Gypsophila grandiflora* Poiret, Encycl. Suppl. 2 (1811) 874. This species was described from a specimen in Desfontaine's herbarium which has neither a number nor a type locality. This specimen is not present in (FI) where Desfontaine's herbarium is supposed to be. The present author doubts whether this species is a *Gypsophila*.

*Gypsophila laricina* Schreber, Nov. Act. Nat. Cur. 4 (1770) 138. Type: Schreber? from Armenia between Erzurum and Tokat. (? not seen). It is difficult to judge which *Gypsophila* species of the section *Capituliformes* Williams is meant here.

*Gypsophila monginii* Hort. ex Möller, Deutsch. Gärtner-Zeit. 46 (1931) 296. Type: described from living garden material. This species is probably a cultiform of *Gypsophila paniculata* L.

*Gypsophila nudicaulis* Rafin., Autikon Bot. (1840) 26. This species was described from the Carpathian mountains. The type was burnt in the war. The present author is not able to guess which *Gypsophila* species is meant here.

*Gypsophila paniculata* L. ssp. *lituanica* Zapalowicz, Consp. Fl. Gall. 3 (1906) 104. Type: Gorski from Pieniuga distr. Wokowysk in Lithuania (? not seen). Probably this subspecies is a form of *Gypsophila paniculata*.

*Gypsophila paniculata* L. var. *linearifolia* Parsa, Fl. de l'Iran 1, 2 (1951). Type: Parsa from Rasht, Guilan in north Iran (Tehran, not seen). In the herbarium collections which the author saw no *Gypsophila paniculata* specimen was recorded from Iran.

*Gypsophila parviflora* Moench, Meth. (1794) 60. This species was described from a garden specimen. It is most probable that it is a cultiform of *Gypsophila paniculata* L.

*Gypsophila pauli* Klokov, Bot. Journ. U.S.S.R. 5, 1 (1948) 25. Type: Klokov from South-east Ukrainia (? not seen). This species is probably a glabrous form or variety of *Gypsophila perfoliata* L.

*Gypsophila prostrata* L., Sp. pl. 1195 (1752). Type: Hort. Upps. 9 (BM)!

*Gypsophila pulchra* Stapf, Denkschr. Acad. Wien 281 (1886). Type: Iran, in fields near Jalpan, Stapf (W not seen). This species may be a *Saponaria*.

*Gypsophila scariosifolia* Parsa, Pl. Nov. Iran (1946) 1. Type: Mobayène from West Iran, Khorasan (Tehran, not seen). This species is similar to *Gypsophila acutifolia* Fisch.

*Gypsophila suffruticosa* Rafin., Autikon Bot. (1840) 26. No type specimen or any other specimen is cited. The description is very short and not indicative in anyway. It was described from the Carpathes.

*Gypsophila tekirae* Stefanoff, Bull. Soc. Bot. Bulgar. 3 (1922) 77. Type: St. Georgieff s.n. from Bulgaria, Tekira near Tatar-Pazardjik (? not seen). This species is probably a glabrous form of *Gypsophila perfoliata* L.

*Gypsophila tubulifera* Bornmüller, Beih. Bot. Centralbl. 31, 2 (1914) 191. Basionym: *Gypsophila tubulosa* Post, Fl. Syr. Pal. Sin. (1896) 5, non Boiss. Type specimen: Post s.n. from Lebanon, Djazzin (Beirut, not seen).

*Gypsophila visianii* Beguinot, Fedd. Rep. Nov. Sp. 5 (1908) 97. Type: Mazzoleni s.n. from Dalmatia, Dinara mountains near Ukovaz (herb. Visiani? not seen). This species is probably *Gypsophila papillosa* Porta. In my opinion it is wrong to include it under *G. fastigiata* L. because it is completely glabrous and the leaves are acute.

#### EXCLUDED SPECIES

*Gypsophila acerosa* (Boiss.) Boissier, Fl. Or. 1 (1867) 558 = *Acanthophyllum acerosum* (Boiss.) Barkoudah comb. nov. Basionym: *Saponaria acerosa* Boiss., Diagn. ser. 2, 1 (1853) 69. Type: Griffith 1003 from Afghanistan (K)!

*Gypsophila aggregata* L., Sp. Pl. (1753) 406 = *Arenaria tetraquetra* L.

*Gypsophila alsinoides* Bunge, Arb. Naturf. Ver. Riga, 1, 2 (1847) 179 = *Arenaria bungei* Barkoudah nom. nov. Type: Bunge s.n. from the river bed of Jan Darja, between Jazd and Isfahan, Iran (L, P)!

*Gypsophila antilibanotica* Post, Pl. Postianae 2 (1891) 6 = *Acanthophyllum kurdicum* Boiss. et Hausskn. Type: Post 166 from the Antilebanon of Syria (Beirut, BM)!

*Gypsophila arborea* Medikus, Beobacht. (1783) 160. The present author is not able to conclude from the description of this species whether it is a *Caryophyllaccae* or not. The flower has 4 sepals, 8 petals, 8 stamens? It is most probable that the type was destroyed in Berlin.

*Gypsophila arenicola* Duf., Bull. Soc. Bot. Fr. 7 (1860) 240 = *Tunica saxifraga* (L.) Scop.

*Gypsophila armerioides* Ser. in DC. Prod. 1 (1824) 353 = *Tunica sibthorpii* Boiss.

*Gypsophila arsusiana* (Kotschy) Williams, Jour. Bot. 27 (1889) 322 = *Ankyropetalum arsusianum* Kotschy (see p. 175).

*Gypsophila bellidifolia* Boissier, Diagn. ser. 1, 1 (1842) 11 = *Saponaria barbata* Barkoudah nom. nov. Type: Aucher-Eloy 4263 from Masqat, Oman (G-Boiss., FI)!

*Gypsophila biovulata* Stapf, Hooker, Icon. Pl. 24 (1894) t. 2332 = *Saponaria biovulata* (Stapf) Barkoudah comb. nov. Type: Stapf s.n. from Iran, above the great springs of Daleki, near Bushire (K)!

*Gypsophila boissieri* Vis, Mem. Inst. Ven. 15: 16 (1870) = *Acanthophyllum spergulifolium* (Jaub. et Sp.) Barkoudah (see further for the basionym).

*Gypsophila cherlerioides* Bornmüller, Mitteil. Thüring. Bot. Ver. 23



- (1908) 2 = *Bolanthus cherlerioides* (Bornm.) Barkoudah (see p. 170).  
*Gypsophila coelesyriaca* (Boiss.) Williams, Jour. Bot. 27 (1889) 322 = *Ankyropetalum gypsophiloides* Fenzl (see p. 174).  
*Gypsophila compressa* Desf., Fl. Atlant. 1 (1800) 343, t. 97. = *Tunica compressa* (Desf.) Fisch. & Mey.  
*Gypsophila cretica* Grisebach, Spicil. Fl. Rumel. 1 (1843) 184 = *Tunica illyrica* Fisch. & Mey.  
*Gypsophila cretica* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 280 = *Tunica cretica* (Sibth. & Sm.) Fisch. & Mey. Drawing: Sibth. & Sm., Icon. Fl. Graec. (1825) t. 384.  
*Gypsophila dianthoides* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 280 = *Tunica dianthoides* (Sibth. & Sm.) Fisch. & Mey. Drawing: Sibth. & Sm., Icon. Fl. Graec. (1823) t. 283.  
*Gypsophila dioica* (Schlecht.) Spreng., Syst. 4. Cur. Post. (1827) 178 = *Silene antirrhina* L. Basionym: *Saponaria dioica* Schlechtendal, Linnaea 1 (1826) 38.  
*Gypsophila erinacea* Boissier, Fl. Or. 1 (1867) 557 = *Acanthophyllum laxiflorum* Boiss. Type: (of both names) Griffith 281 cat. from Afghanistan (K,P)!  
*Gypsophila fasciculata* Margot & Reut., Mém. Soc. Physic. Genève 8 (1839) 281, t. 1 = *Tunica fasciculata* (Marg. & Reut.) Boiss., Fl. Or. Suppl. (1888) 82.  
*Gypsophila fasciculata* Marg. & Reut. var. *laconica* Boiss., Fl. Or. 1 (1867) 556 = *Bolanthus laconicus* (Boiss. & Heldr.) Barkoudah (see p. 163).  
*Gypsophila filicaulis* (Boiss.) Bornmüller, Beih. Bot. Centralbl. 31, 2 (1914) 191 = *Bolanthus filicaulis* (Boiss.) Barkoudah (see p. 167).  
*Gypsophila filipes* (Boiss.) Šiškin in Komarov, Fl. U.S.S.R. 6 (1936) 775 = *Saponaria filipes* Boiss. Type: Griffith 1643 from Afghanistan (G-Boiss.).  
*Gypsophila floribunda* (Kar. & Kir.) Turcz. ex Ledebour, Fl. Ross. 1 (1842) 775 = *Saponaria filipes* Boiss. Basionym: *Dichoglottis floribunda* Kar. & Kir. Type: Karelin & Kiriloff s.n. from Pamir-Alai, between the rivers Ajugus and Lepsa (BR, K, M, P)!  
var. *major* Boissier, Fl. Or. 1 (1867) 553 = *Saponaria filipes* Boiss. var. *filipes*. Type: the same as that of the species.  
var. *conferta* Boissier, l.c. = *Saponaria filipes* Boiss. var. *conferta* (Boiss.) Barkoudah comb. nov. Type: Bunge from Iran, between Yezd and Isfahan (FI, P)!  
*Gypsophila frankenioides* Boissier, Diagn. ser. 1, 1 (1842) 10 = *Bolanthus frankenioides* (Boiss.) Barkoudah (see p. 169).  
var. *fasciculata* Boiss. & Heldr., Diagn. ser. 1, 8 (1849) 58 = *Bolanthus frankenioides* (Boiss.) Barkoudah var. *fasciculatus* (Boiss. & Heldr.) Barkoudah (see p. 169).  
var. *libanotica* Boissier, Fl. Or. 1 (1867) 555 = *Bolanthus frankenioides* (Boiss.) Barkoudah var. *libanoticus* (Boiss.) Barkoudah (see p. 169).  
*Gypsophila fruticulosa* (Bory & Chaub.) Boissier, Fl. Or. 1 (1867) 556

= *Bolanthus fruticosus* (Bory & Chaub.) Barkoudah comb. nov. (see p. 164).

*Gypsophila galiifolia* Gilli, Fedd. Rep. Beiheft 59, 2 (1956) 165 = *Acanthophyllum honigbergeri* (Fenzl) Barkoudah comb. nov. (see further for the basionym of this new combination). Type: Gilli 1264 from Afghanistan, near Kabul (W)!

*Gypsophila graeca* (Schreber) Britten, Jour. Bot. (1906) 345 = *Bolanthus graecus* (Schreber) Barkoudah (see p. 166).

*Gypsophila graminea* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 279 = *Tunica graminea* (Sibth. & Sm.) Boiss. Type: Sibthorp s.n. from Peloponnesus, Greece (OXF herb. Sibth.)!

*Gypsophila hirsuta* (Labil.) Spreng., Syst. 2 (1826) 373 = *Bolanthus hirsutus* (Labil.) Barkoudah (see p. 168).

var. *alpina* Boissier, Fl. Or. 1 (1867) 557 = *Bolanthus hirsutus* (Labil.) Barkoudah var. *alpinus* (Boiss.) Barkoudah (see p. 168).

var. *barradensis* Boissier, Diagn. 1, 8 (1849) 72 = *Bolanthus hirsutus* (Labil.) Barkoudah var. *barradensis* (Boiss.) Barkoudah (see p. 169).

var. *flicaulis* Boissier, Fl. Or. 1 (1867) 557 = *Bolanthus flicaulis* (Boiss.) Barkoudah (see p. 167).

var. *mollis* Boissier, Fl. Or. 1 (1867) 556 = *Bolanthus hirsutus* (Labil.) Barkoudah (see p. 168).

var. *ocellata* Boissier, Fl. Or. 1 (1867) 556 = *Bolanthus graecus* (Schreb.) Barkoudah (see p. 166).

var. *thymifolia* Boissier, Fl. Or. 1 (1867) 556, quoad typum = *Bolanthus graecus* (Schreber) Barkoudah var. *thymifolius* (Sibth. & Sm.) Barkoudah (see p. 167).

*Gypsophila honigbergeri* (Fenzl) Boissier, Fl. Or. 1 (1867) 558 = *Acanthophyllum honigbergeri* (Fenzl) Barkoudah comb. nov. Basionym: *Saponaria honigbergeri* Fenzl. Type: Honigberger s.n. from Afghanistan, Kabul (G-Boiss.)!

*Gypsophila illyrica* Nym., Syll. (1854) 237, a misapplied name of *Gypsophila illyrica* Sibth. & Sm. = *Tunica illyrica* Fisch. & Mey.

*Gypsophila illyrica* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 281 = *Tunica sibthorpii* Fisch. & Mey. Drawing: Sibth. & Sm., Icon. Fl. Graec. (1825) t. 386.

*Gypsophila jaubertiana* Boissier, Fl. Or. Suppl. (1888) 89 = *Acanthophyllum spergulifolium* (Jaub. & Sp.) Barkoudah comb. nov. Basionym: *Heterochroa spergulaefolia* Jaub. et Sp., Ill. pl. Or. 1: t. 12 (1842).

*Gypsophila kermanensis* (Bornmüller) Simmler, ex Stroh, Beih. Bot. Centralbl. 59 (1939) 470 = *Saponaria kermanensis* Bornmüller. Type: Bornmüller 2265 from Iran, prov. Kerman, Kuh-i-dsihupar Mt. (P)!

*Gypsophila laconica* Boissier et Heldreich, Fl. Or. Suppl. (1888) 88 = *Bolanthus laconicus* (Boiss.) Barkoudah (see p. 163).

*Gypsophila laxiflora* (Boiss.) Rechinger f., Fedd. Rep. Beiheft 59, 2 (1956) 163 = *Acanthophyllum laxiflorum* Boiss. Type: Griffith 281 cat. from Afghanistan (K, P)!

*Gypsophila minuartioides* (Jaub. & Sp.) Boissier, Fl. Or. 1 (1867) 558 = *Acanthophyllum minuartioides* (Jaub. & Sp.) Barkoudah comb. nov. Basionym: *Heterochroa minuartioides* Jaub. & Sp., Illustr. Pl. Or. 1 (1843) t. 12!

*Gypsophila mollis* (Boiss.) Bornmüller, Beih. Bot. Centralbl. 31, 2 (1914) 191 = *Bolanthus hirsutus* (Labil.) Barkoudah (see p. 168).

*Gypsophila montana* Balfour f., Proc. Roy. Soc. Edinb. 11 (1882) 501 = *Saponaria montana* (Balfour) Barkoudah comb. nov. Type: Balfour, B. 442 from Socotra (E, P)!

var. *diffusa* Balfour f., Bot. Soc. Trans. Roy. Sc. Edinb. 31 (1888) 20 = *Saponaria montana* (Balf.) Barkoudah var. *diffusa* (Balf.) Barkoudah comb. nov. Balfour did not mention any type or other specimen under this variety.

var. *viscida* Balfour f., Bot. of Socotra, Transact. Roy. Sc. Ed. 31 (1888) 20 = *Saponaria montana* (Balf.) Barkoudah ssp. *somalensis* (Franch.) Barkoudah comb. nov. (see further for the basionym). Type: Balfour 554 (BM)!

*Gypsophila multicaulis* Poiret, Encyc. Suppl. 2 (1812) 875 = *Tunica saxifraga* (L.) Scop.

*Gypsophila ochroleuca* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 281 = *Tunica ochroleuca* (Sibth. & Sm.) Boiss. Drawing: Sibth. & Sm., Icon. Fl. Graec. (1825) t. 385!

*Gypsophila ocellata* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 281 = *Bolanthus graecus* (Schreber) Barkoudah (see p. 166).

*Gypsophila ortegioides* (Fisch. & Mey.) Boissier, Fl. Or. 1 (1867) 552 = *Phryna ortegioides* (Fisch. & Mey.) Pax & Hoffmann (see p. 176).

*Gypsophila pachygona* (Fisch. & Mey.) Dietr., Syn: Pl. 2 (1852) 1543 = *Tunica pachygona* Fisch. & Mey.

*Gypsophila permixta* Guss., Suppl. Fl. Sic. Prod. (1843) 120 = *Tunica saxifraga* (L.) Scop.

*Gypsophila picta* (Boiss.) Boissier, Fl. Or. 1 (1867) 554 = *Saponaria picta* Boiss. in Tchichatschef, As. Min. (1860) 202. Basionym: *Saponaria picta* Boiss. Type: Bourgeau, E. s.n. from Turkey, near Gumus-khané (P)!

var. *micrantha* Bornmüller et Woronow, Fedd. Rep. 89 (1940) 105 = *Saponaria picta* Boiss. var. *micrantha* (Bornmüller & Woronow) Barkoudah comb. nov.

*Gypsophila polygonoides* (Willd.) Halácsy, Consp. Fl. Graec. 1 (1900) 191 = *Bolanthus graecus* (Schreber) Barkoudah (see p. 166).

ssp. *ansariensis* Rechinger f., Ark. Bot. 5, 1 (1960) 118 = *Bolanthus filicaulis* (Boiss.) Barkoudah var. *ansariensis* (Rechinger) Barkoudah (see p. 168).

ssp. *ocellata* (Sibth. & Sm.) Halácsy, l.c. 220 = *Bolanthus graecus* (Schreber) Barkoudah (see p. 166).

ssp. *thessala* (Jaub. & Sp.) Hayek, Fl. Balc. 1 (1927) 221 = *Bolanthus thessalus* (Jaub. & Sp.) Barkoudah (see p. 164).

*Gypsophila popovii* Preobrashensky in Korovin and Popov, Descr. Pl. Nov. Turkest. (1916) 47 = *Acanthophyllum popovii* (Preobr.)

Barkoudah comb. nov. Type: Popov s.n. from Pamir-Alai, Kugitang (LE not seen).

*Gypsophila raphiophylla* Rechinger, f., Österr. Bot. Zeit. 104 (1957) 173 = *Acanthophyllum raphiophylla* (Rechinger) Bark. comb. nov.

*Gypsophila reuteri* (Boiss. & Hausskn.) Williams, Jour. Bot. 27 (1889) 322 = *Ankyropetalum reuteri* Boiss. & Hausskn. (see p. 174).

*Gypsophila rigida* L., Sp. Pl. (1753) 408 = *Tunica saxifraga* (L.) Scop.

*Gypsophila saxifraga* L., Syst. ed. 10 (1758) 1028 = *Tunica saxifraga* (L.) Scop.

*Gypsophila scapiflora* Akhtar, Indian Forester 66 (1940) 606 = *Acanthophyllum acerosum* (Boiss.) Barkoudah var. *scapiflorum* (Akhtar) Barkoudah comb. nov. Type: Akhtar 85864 from Afghanistan, near Kabul (DD)!

*Gypsophila somalensis* Franch., in Révoil, Çomali (1882) 14 = *Saponaria montana* (Balfour) Barkoudah ssp. *somalensis* (Franch.) Barkoudah comb. nov. Type: Revoil, G. 12 from Somaliland, Lasgoria, Geldora valley (P)!

*Gypsophila stewartii* Thoms. ex Edgew. & Hooker f., Fl. Brit. Ind. 1 (1875) 216 = *Acanthophyllum stewartii* (Thoms.) Barkoudah comb. nov. Type: Stewart, J. L. s.n. from N. W. India (E, K)!

*Gypsophila stricta* Bunge in Ledebour, Fl. Alt. 2 (1830) 129 = *Tunica stricta* (Bunge) Boiss. Drawing: Ledebour, Icon. Fl. Ross. Alt. Illustr. 1 (1829) t. 5!

*Gypsophila thessala* (Boiss.) Nym., Syll. (1854) 238 = *Tunica thessala* Boiss.

*Gypsophila thymifolia* Sibth. & Sm., Fl. Graec. 4 (1806) 79, t. 388 = *Bolanthus graecus* (Schreber) Barkoudah var. *thymifolius* (Sibth. & Sm.) Barkoudah (see p. 167).

*Gypsophila vaccaria* Sibth. & Sm., Fl. Graec. Prod. 1 (1806) 279 = *Vaccaria parviflora* Moench.

منه حالياً . وكل نوع من الأنواع المدروسة له وصف مختصر مع رسوم لأجزاء الزهرة والثمرة والبذور فيه ، مع ذكر المناطق الجغرافية التي ينتشر فيها النوع وشروط الوسط الذي ينمو فيه ، وأخيراً عدد من العينات التي اعتمد عليها الباحث في وصفه والمتاحف التي توجد فيها هذه العينات . ويتهى البحث بفهرس للكتب والمقالات التي تتعلق بهذا البحث وفهرس لأسماء الأشخاص الذين جمعوا العينات ، وفهرس ثالث لأسماء الأنواع المختلفة ومكان ورودها في البحث .

العموم بلهوائي يميني dextrorsely convoluted وهذا ما دعى الباحث الى الجزم بأن لا علاقة بين ترتيب الأوراق الكأسية و ترتيب الأوراق التويجية في الأجناس المدروسة .

ولقد درست براعم زهرية مختلفة الحجم لأنواع ثمانية لمتابعة مراحل تطوّر البرعم الزهري من بداية التشكل حتى مرحلة تفتح الزهرة . فالأس أول أجزاء الزهرة التي تبدد للعيان يتشكل على مرحلتين ؛ أولاً الأسنان الكأسية ، ثم الأنيوب الكأسي . بعد ذلك تبدأ الأُسدية بالظهور ؛ أولاً الأُسدية المقابلة للكأسيات ثم الأُسدية المقابلة للتويجيات ؛ ثم تبدأ الأُخبية بالظهور ؛ وأخيراً يبدأ التويج بالتشكل . ولقد لاحظ الباحث أن المبيض في الأجناس المدروسة يكون في المراحل الأولى من التشكل مقسوماً الى مجريتين ، ولكن الحجاب الفاصل يزول قبل أن تفتح الزهرة ولا يبقى منه إلا العمود المشيمي في مركز المبيض . ولقد اعتبر الباحث هذا النوع من المشيمة جزءاً من الأُخبية وليس جزءاً من الساق كما يدعي البعض .

وقد خلّصت المعطيات الخلوية حول هذه الأجناس مع قائمة لعدد الصبغيات

المعروفة حتى الآن من الجنس *Gypsophila* مع التفسيرات التي وردت عنها .

ينتشر الجنس *Gypsophila* في النصف الشمالي من العالم القديم بين خطي العرض  $30^{\circ}$  و  $60^{\circ}$  بصورة خاصة . ويتركز قسم كبير من الأنواع (75) في تركيا والبلاد المجاورة لها ، وهذا ما سماه الباحث مركز التنوع لجميع تحت الأجناس والفصوله التي يتألف منها الجنس *Gypsophila* ممثلة في مركز التنوع المذكور . وأكثر من نصف الأنواع التي تنتشر في مساحة محدودة توجد في منطقة مركز التنوع . وهذا ما دعى الباحث إلى الفرض بان منطقة مركز التنوع هي مهد الجنس بكامله .

تمحو أغلب أنواع الجنس *Gypsophila* في البراري التابعة للمنطقة الإيرانو-تورانية

التي حددها الباحث Eig (1931) .

تستعمل بعض أنواع هذا الجنس كنباتات للزينة في الحدائق ، كما يزرع البعض منها لإستحصال مادة الصابونين الموجودة بوفرة في الجذور ، ونوع واحد يستعمل كوقود في المناطق التي تقتقر الى الأخشاب .

اما القسم التصنيفي فيحموي على وصف للأجناس *Gypsophila* = 127 نوعاً منها

19 نوعاً جديداً *Phryna* = نوع واحد ، *Bolanthus* = 8 أنواع ، *Ankyropetalum* = 3

أنواع . ولقد صنع الباحث مفتاحاً للأجناس القبيلة *Diantheae* ومفاتيح لأنواع الأجناس المدروسة . كما وضع الباحث تصنيفاً جديداً للجنس *Gypsophila* . يشمل جميع الأنواع المعروفة

## خُلَاصَةٌ

دراسة تصنيفية في الجنس *Gypsophila*

والأجناس المتعلقة به في تحت العائلة *Silenoideae*

الطروحة لنيل شهادة الدكتوراة بقلم يوسف ابراهيم بركوده

في عام ١٩٥٨ أوفدت جامعة دمشق الباحث الى هولندا لمدة أربع سنوات لتحضير شهادة دكتوراة في علم النبات . ولقد تكرم الأستاذ البرفسور J. Lanjouw فقبل أن يجري هذا البحث تحت إشرافه في المتحف النباتي التابع بجامعة أوترخت . ولقد أمكن عن طريق المعهد المذكور استعارة جميع العينات المجمعة التابعة للأجناس المدروسة والموجودة في المتاحف النباتية في جميع بلاد أوروبا تقريباً .

يبدأ البحث بعرض للأجزاء المختلفة حول تصنيف الجنس *Gypsophila* وحدوده، ثم يضع الباحث وجهة نظره حول حدود الأجناس المدروسة وعلاقتها مع بعضها ومع

الأجناس الأخرى في تحت العائلة *Silenoideae*

ولقد قام الباحث بدراسة مقارنة لأجزاء النبات؛ الجذر، الساق، الأوراق، الإزهار، الزهرة وأجزائها، الثمرة والبذور في الأنواع المختلفة. فالجذر العميق المتخشب والساق الذي يتجدد كل عام إن هي إلا صفات توهم أنواع هذه الأجناس للعيش في البراري الجافة . والأوراق قليلة على الساق أو إنَّها صغيرة مما يساعد على تقليل سطح الإنفصال أثناء فصل الصيف الحار في المناطق التي تنتشر فيها هذه الأجناس . ولقد أيدَّ الباحث نظرية إرجاع نظام الأوراق المتعاقبة الموجود في عائلة *Caryophyllaceae* الى النظام الحلزوني بناء على بعض الملاحظات التي أجريت على نباتات حيّة . أما مشكلة انحراف الأوراق المتعاقبة عن التعاقب التام فلقد فسرت تبعاً لنظرية من الفراغ في البرعم الورقي .

تترتب الأوراق الكأسية في البرعم الزهري تبعاً لحلزون موافق لدوران عقرب الساعة أو معاكس لدوران عقرب الساعة . والنبات الواحد وحتى الغصن الواحد من الإزهار يحمل كؤوساً ذات حلزون موافق لدوران عقرب الساعة يساوي عددها عدد الكؤوس ذات الحلزون المعاكس لدوران عقرب الساعة . ولقد فسّر الباحث هذه النتيجة عن طريق نظرية من الفراغ في البراعم الزهرية . أما ترتيب الأوراق التوجيهية في هذه الأجناس فهو على

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The numbers in parentheses correspond with the following species numbers. Only numbered collections have been listed.

1. *G. aretioides* Boiss.
2. *G. imbricata* Rupr.
3. *G. serpylloides* Boiss. et Heldr.
4. *G. saponarioides* Bornm. et Gaub.
5. *G. adenophylla* Bark.
6. *G. rosea* Bark.
7. *G. nana* Bory et Chaub.
  - a. var. *nana*
  - b. var. *glabrifolia* Halácsy
8. *G. achaia* Bornm.
9. *G. spergulifolia* Griseb.
  - a. var. *spergulifolia*
  - b. var. *serbica* Vis. et Panč.
10. *G. davisii* Bark.
11. *G. repens* L.
  - a. var. *repens*
  - b. var. *archetypa* Murr.
  - c. var. *alpina* Brugg.
  - d. var. *montana* Rchb.
12. *G. caricifolia* Boiss.
13. *G. acantholimoides* Bornm.
14. *G. graminifolia* Bark.
15. *G. altissima* L.
16. *G. litwinowii* K. Pol.
17. *G. cephalotes* (Schrenk.) Williams
18. *G. fastigiata* L.
  - a. var. *fastigiata*
  - b. var. *arenaria* (W. & K.) Fries
19. *G.* × *digenea* Borb.
20. *G. papillosa* Porta
21. *G. struthium* L.
22. *G. iberica* Bark.
23. *G. collina* Stev.
24. *G. oldhamiana* Miq.
25. *G. ellipticifolia* Bark.
26. *G. davorica* Turcz.
27. *G. patrinii* Ser.
  - a. var. *patrinii*
  - b. var. *caespitosa* (Turcz.) Šiškin
  - c. var. *thesifolia* (Ser.) Šiškin
28. *G. pacifica* Komar.
29. *G. preobrashenskii* Czern.
30. *G. licentiana* Hand.-Mazz.
31. *G. sambukii* Šiškin
32. *G. capituliflora* Rupr.
33. *G. mongolica* Bark.
34. *G. uralensis* Lessing
35. *G. brachypetala* Trautv.
36. *G. steupii* Šiškin
37. *G. tenuifolia* M. Bieb.
  - a. var. *tenuifolia*
  - b. var. *subcapitata* Rupr.
38. *G. sphaerocephala* Fenzl
  - a. var. *sphaerocephala*
  - b. var. *cappadocica* (Boiss. & Balansa) Boiss.
39. *G. pilulifera* Boiss. et Heldr.
40. *G. syriaca* Šiškin
41. *G. olympica* Boiss.
42. *G. transsylvanica* Spreng.
43. *G. capitata* M. Bieb.
44. *G. pinifolia* Boiss. et Hausskn.
45. *G. lignosa* Hemsl. et Lace
46. *G. glomerata* Pallas
47. *G. globulosa* Stev.
48. *G. paniculata* L.
  - a. var. *paniculata*
  - b. var. *adenopoda* Borb.
49. *G. bicolor* (Frey & Sint) Grossh.
50. *G. arrostii* Guss.
  - a. var. *arrostii*
  - b. var. *pubescens* Guss.
  - c. var. *nebulosa* (Boiss. & Heldr.) Bark.
51. *G. simulatrix* Bornm. et Woron.
52. *G. krascheninnikovii* Šiškin
53. *G. belorossica* Bark.
54. *G. acutifolia* Fisch.
55. *G. stevenii* Fisch.
56. *G. meyeri* Rupr.
57. *G. albida* Šiškin
58. *G. scariosa* Tauch.
59. *G. perfoliata* L.
  - a. var. *perfoliata*
  - b. var. *anatolica* (Boiss. & Held.) Bark.
60. *G. scorzoniferifolia* Ser.
61. *G. tomentosa* L.
62. *G.* × *castellana* Pau
63. *G. robusta* Grossh.
64. *G. oblanceolata* Bark.
65. *G. nabelekii* Šiškin
  - a. var. *nabelekii*
  - b. var. *lipskyi* (Šiškin) Bark.
66. *G. briquetiana* Šiškin
67. *G. curvifolia* Fenzl
68. *G. libanotica* Boiss.
69. *G. ruscifolia* Boiss.
70. *G. damascena* Boiss.
71. *G. pallida* Stapf
  - a. var. *pallida*
  - b. var. *haussknechtii* (Boiss.) Bark.
72. *G. aucheri* Boiss.
  - a. var. *aucheri*
  - b. var. *adenoclada* (Bornm.) Bark.
73. *G. pallidifolia* Bark.
74. *G. virgata* Boiss.

75. *G. transcaucasica* Bark.  
 76. *G. aulicatis* Fedtsch.  
 77. *G. eriocalyx* Boiss.  
   a. var. *eriocalyx*  
   b. var. *henrici* (Czecz.) Bark.  
 78. *G. lepidioides* Boiss.  
 79. *G. cerastioides* D. Don  
 80. *G. desertorum* (Bunge) Fenzl  
 81. *G. violacea* (Ledeb.) Fenzl  
 82. *G. glandulosa* (Boiss.) Walp.  
 83. *G. secicea* (Ser.) Krylov  
 84. *G. microphylla* (Schrenk) Fenzl  
 85. *G. turkestanica* Šiškin  
 86. *G. sedifolia* Curz.  
 87. *G. herniarioides* Boiss.  
 88. *G. antominae* Šiškin  
 89. *G. melampoda* Bien.  
 90. *G. heteropoda* Freyn et Sint  
   a. ssp. *heteropoda*  
   b. ssp. *minutiflora* Bark.  
 91. *G. pseudomelampoda* Gauba et Reching. f.  
 92. *G. diffusa* Fisch. et Mey.  
 93. *G. adenophora* Boiss. et Buhse  
 94. *G. mucronifolia* Reching. f.  
 95. *G. szovitsii* Fisch. et Mey.  
 96. *G. parva* Bark.  
 97. *G. linearifolia* (F. & M.) Boiss.  
 98. *G. spathulifolia* (Fisch. & Mey.) Fenzl  
 99. *G. muralis* L.  
 100. *G. macedonica* Vandás  
 101. *G. tubulosa* (Jaub. & Sp.) Boiss.  
 102. *G. australis* (Schlecht.) Gray  
 103. *G. confertifolia* Hub.-Mor.  
 104. *G. elegans* M. Bieb.  
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   b. var. *latipetala* Bark.  
 105. *G. silenoides* Rupr.  
 106. *G. iranica* Bark.  
 107. *G. bitlisensis* Bark.  
 108. *G. viscosa* Murr.  
 109. *G. capillaris* (Forsk.) Christ.  
 110. *G. arabica* Bark.  
 111. *G. antari* Post et Beauverd  
 112. *G. obconica* Bark.  
 113. *G. xanthochlora* Reching. f.  
 114. *G. persica* Bark.  
 115. *G. polyclada* Fenzl  
   a. var. *polyclada*  
   b. var. *glandulosa* Bark.  
 116. *G. lurorum* Reching. f.  
 117. *G. hispida* Boiss.  
 118. *G. fedtschenkoana* Šiškin  
 119. *G. villosa* Bark.  
 120. *G. pilosa* Hudson  
 121. *G. platyphylla* Boiss.  
 122. *G. boissieriana* Hausskn. et Bornm.  
 123. *G. nodiflora* (Boiss.) Bark.  
 124. *G. bucharica* Fedtsch.  
 125. *G. intricata* Franch.  
 126. *G. venusta* Fenzl  
 127. *B. laconicus* (Boiss. & Held.) Bark.  
 128. *B. fruticosus* (Bory & Chaub.) Bark.  
 129. *B. thessalus* (Jaub. & Sp.) Bark.  
 130. *B. graecus* (Schreber) Bark.  
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   b. var. *thymifolius* (Boiss.) Bark.  
 131. *B. filicaulis* (Boiss.) Bark.  
   a. var. *filicaulis*  
   b. var. *ansariensis* (Reching.) Bark.  
 132. *B. hirsutus* (Labil.) Bark.  
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   b. var. *alpinus* (Boiss.) Bark.  
   c. var. *barradensis* (Boiss.) Bark.  
 133. *B. frankenioides* (Boiss.) Bark.  
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   b. var. *libanoticus* (Boiss.) Bark.  
   c. var. *fasciculatus* (Boiss. & Held.) Bark.  
 134. *B. cherlerioides* (Bornm.) Bark.  
 135. *A. gypsophiloides* Fenzl  
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   b. var. *viscosum* Bark.  
   c. var. *coelesyriacum* (Boiss.) Bark.  
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