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Research Article

New species of the family Crassulaceae J. St.-Hil. in the flora of the Nakhchivan Autonomous Republic of Azerbaijan

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Abstract

For high-mountain vegetation, especially rocky-rubble landscapes, the family *Crassulaceae* J.St.-Hil. is characteristic. The first classification of the *Crassulaceae* family was given by Burnett G.T. (Burnett G.T., 1835), and the last one was more fully developed by Thiede Joachim & Eggli Urs. (Thiede Joachim.) & Eggli Urs., 2007). It is shown by Christenhusz Maarten J.M., Zhang Xian-Chun, and Schneider Harald (Christenhusz Maarten J.M. et al 2011) that the *Crassulaceae* family is represented by 1400 species in 35 genera worldwide. On the territory of the Nakhchivan Autonomous Republic, 21 species belonging to 6 genera were noted in the *Crassulaceae* family. During the expeditions to the Zangezur ridges, we discovered new species of *Sempervivum montanum* L. and *Sedum acre* L. for the flora of the autonomous republic. The territory of the Nakhchivan Autonomous Republic is home to 6 genera and 23 species of the family Crassulaceae J.St.-Hil.

Keywords: Crassulaceae, flora, Sedum, Sempervivum, Rosularia, taxonomic spectrum

Introduction

The vegetation of high mountain areas, especially rocky-rubble landscapes, is relatively untransformed in each country, and even some impassable rocky areas have landscapes that have preserved their natural appearance, far from anthropogenic impact. Any species serves as an indicator plant for predicting global climate change because anthropogenic factors, which are the main influences on species, are absent in these areas. Since our country is a typical mountainous region, the vegetation of rocks and swamps here is also more characteristic and has its own characteristics. Studies of rock and rubble vegetation in the Nakhchivan Autonomous Republic have

not been conducted, and little information is provided on some plant species in this area. Rocky-rubble landscapes, as in other regions of the Caucasus, form a huge ecosystem in the territory of the Nakhchivan Autonomous Republic. A.A. Grossheim (Grossgeim, 1946) writes in his work "Plant Resources of the Caucasus": "In the Caucasus, especially in its central part, rocky-rubble landscapes have reached a very high degree of development. An accurate classification of rocky-rubble vegetation has not yet been carried out". These words can also be attributed to the Lesser Caucasus and its northwestern part. Alpine and subalpine vegetation of the Greater and Lesser Caucasus was studied by V.C. Gadzhiev (Gadzhiev, 1974). In works written on the basis of the research results, information on rocky-rubble vegetation was also presented. However, a systematic study of rocky-rubble vegetation has not been carried out. The main reason for the unresolved problem is the inaccessibility of places where rocks and rubble are found in the highlands.

Scientific expeditions were conducted only on mountain slopes. One of the urgent tasks of modern botany is to continue studying the poorly studied vegetation of rocks and rubble. The solution to this problem is important for understanding the patterns of cytogenesis, detecting rare endemic and relict species, studying their ecology, and ultimately for determining the ways of their effective use (Shkhagapsoev et al, 1987). It can also provide valuable material for solving several theoretical and practical problems of phytocoenology. Among the vegetation of rocks and rubble, there are high-quality forage plants, the seeds of which can be used to restore mountain meadows. In addition to forage plants, ornamental, rock-strengthening, medicinal, and other groups of valuable plants are common on rocks and rubble. In this regard, the study of rock-rubble vegetation is of great practical importance. Plant families grow on mountain slopes, dry rocky areas, stony places, and forest edges. Some species are grown as ornamental plants, and marinades have been prepared from the young leaves of *Sempervivum transcaucasicum* Muirhead (*S. glabrifolium* auct. p.p.) since ancient times, and the leaves and shoot tips of *Sedum album* L. were used to prepare salads. The species reproduces mainly vegetatively.

Materials and Methods

The research material was plants collected in 2024-2025 on the Zangezur Range of the Nakhchivan Autonomous Republic from the *Crassulaceae* J.St.-Hil. family. During the study, using classical and modern botanical-floristic, taxonomic, areological, bioecological, and statistical methods, species belonging to the *Crassulaceae* J.St.-Hil. The family was identified, and their excellent beneficial properties were studied. The work also used methods for studying high-mountain vegetation (Grossgeim, 1935; 1936; Gadzhiev, 1974; Shkhagapsoev, 1987; Grechushkina, 2011). The size of the sample area was 100 m^2. In areas where the size of the landing sites did not allow,

trial plots of 10 m^2 were laid out. Also, within the large trial plot, small plots of 10 m^2 were laid out. Office studies were conducted at the Institute of Bioresources, using the herbaria stored there.

Results

The biological characteristics of both species discovered are as follows:

Sedum acre L. flowers are pentamerous. Stems are numerous, ascending from the base, densely foliated, 5-10 cm high. Leaves are fleshy, ovoid, and obtuse, with a rounded hump at the base 2-5 mm long and 2-3.5 mm wide, densely imbricated on sterile shoots. Flowers in a corymbose inflorescence consisting of spike-shaped branches. Sepals are oblong-ovate, 2-3 mm long. Petals are golden-yellow, lanceolate, acute, up to 5 mm long. Mature fruits are stellate, diverging, lanceolate, with a short, straight beak. Hypogynous scales are very small, almost square (Fig.1).
Sempervivum montanum L. is a small, frost-hardy succulent, 5-20 cm tall, with a resinous smell, forming a carpet of tightly packed rosettes of green, densely pubescent leaves. The rosettes can reach 6 cm in diameter and produce numerous shoots on stolons up to 3 cm long. The rosettes are initially spherical, then spreading, star-shaped, 4-6 cm wide. The leaves of the rosette are thick, fleshy, lanceolate, up to 3 cm long and 0.3 cm wide, densely covered with short glandular hairs (<0.3 mm long). For a more detailed check, it should be noted that Sempervivum montanum has pubescent leaves on the surface. In early summer, inflorescences of reddish-violet star-shaped flowers appear on leafy stems reaching a height of 10-20 cm. Flowers are purple-red (rarely yellowish-white, but even then the stamens are light), 2-3 cm in diameter. There are 11-16 petals, gradually narrowing, 2-2.5-4 times longer than the sepals (Fig. 2).

Figure1. *Sedum acre* L.

Figure 2. *Sempervivum montanum* L.

Discussion

One of the interesting families of biodiversity of flora and vegetation of rocks and rubble of Nakhchivan Autonomous Republic is the family *Crassulaceae* J.St.-Hil., nom. cons. -

Crassulaceae. The first information about this family we draw from the works of the famous florist A.A. Grossheim. In the 2nd volume of the work "Flora of the Caucasus", first published by A.A. Grossheim (Grossheim,1930; 1950), and later in the 2nd volume of the multi-volume "Flora of Azerbaijan", first written by A.A. Grossheim in the national language, the family *Crassulaceae* A. DC. is presented, which provides botanical characteristics and distribution areas of species belonging to 4 genera of the family (*Sedum* L., *Umbilicus* DC., *Sempervivum* L., *Tillaea* L.). Species belonging to the genus *Tillaea* L. are not found in the territory of the Nakhchivan Autonomous Republic; 11 species belonging to other genera are listed.

In the "Plant Guide to the Caucasus" by A.A. Grossheim (Grossheim, 1949; 1950), and in the 4th volume of his reissued "Flora of the Caucasus", in addition to the *Crassulaceae* family, a new genus *Rosularia* (DC.) Stapf is indicated, and additional species are noted in the genus *Sedum* L. In the 4th volume of the multi-volume "Flora of Azerbaijan", published based on research by the Institute of Botany, the taxonomic composition of 4 genera belonging to the family *Crassulaceae* J.St.-Hil. [2022] is given. The genus *Sedum* L. and its sections were developed by I.I. Karyagin, and the remaining genera and species are presented by L.I. Prilipko. Species of the genus *Tillaea* are again not noted for this territory. Thus, out of 30 species of the family, belonging to 4 genera, mentioned in the work "Flora of Azerbaijan", 17 species belonging to 3 genera were noted on the territory of the autonomous republic (Flora of Azerbaijan, 1953).

Thus, as can be seen, when studying the biodiversity of the flora of the Nakhchivan Autonomous Republic, special research work on the family *Crassulaceae* J.St.-Hil. was not carried out, and the definition of the distribution zones of species, their position in phytocenoses, their significance, rare species, and the possibilities of effective use are becoming relevant and await their solution.

T.H. Talibov (Talibov, 2001), in the course of scientific research on the biodiversity of the flora of the Nakhchivan Autonomous Republic, identified the species *Sempervivum armenum* Boiss. & Huet for the flora of Azerbaijan, and on the territory of the autonomous republic, 16 species were noted in the family *Crassulaceae* belonging to 3 genera.

T.H. Talibov and A.Sh. Ibragimov (Talibov et al, 2008), after joint work, compiled a taxonomic spectrum of the flora of the Nakhchivan Autonomous Republic and included the following taxa in the *Crassulaceae* family.

Familia: *Crassulaceae* J.St.-Hil.

1. Genus: *Hylotelephium* H.Ohba

1(1) *Hylotelephium caucasicum* (Grossh.) H.Ohba [*Sedum caucasicum*(Grossh.) Boriss.]

2. Genus: *Macrocepalum* Regel & Schmalh.

2(1) *Macrocepalum tetramerum* (Trautv.) Palanov (*Sedum tetramerum* Trautv.)

3. Genus: *Prometheum* (Berger) H.Ohba

3(1) *Prometheum pilosum* (Bieb.) H.Ohba (*Sedum pilosum* Bieb.)

4(2) *P. sempervivoides* (Fisch. ex Bieb.) H.Ohba

4. Genus: *Rosularia* (DC.) Stapf
5(1) *Rosularia elymaitica* (Boiss. & Hausskn.) Berger
6(2) *R. persica* (Boiss.) Berger
7(3) *R. radiciflora* Steud.ex Boriss.
8(4) *R. sempervivum* (Bieb.) Berger
5. Genus: *Sedum* L.
9(1) *Sedum pilosum* Bieb.
10(2) *S. sempervivoides* Fisch.
11(3) *S. album* L.
12(4) *S. annuum* L.
13(5) *S. corymbosum* Grossh.
14(6) *S. gracile* C.A. Mey.
15(7) *S. hispanicum* L.
16(8) *S. oppositifolium* Sims
17(9) *S. pentapetalum* Boriss.
18(10) *S. subulatum* (C.A. Mey.) Boiss.
19(11) *S. tenellum* Bieb.
6.Genus: *Sempervivum* L.
20(1) *Sempervivum armenum* Boiss. & Huet (*S.glabrifolium* Boriss.)
21(2) *S. caucasicum* Rupr. ex Boiss.

In the work of A.M. Askerov (Askerov, 2016) "Flora of Azerbaijan (Higher Plants - *Embryophyta*)", some changes were made to the systematic division of the family. He considered the species *Sempervivum glabrifolium* auct. p.p a synonym of *Sempervivum transcaucasicum* Muirhead.

Compiled by T.H. Talibov, A.Sh. Ibragimov, and A.M. Ibragimov (Talibov et al, 2021) in the 2nd edition of the work "Taxonomic Spectrum of the Flora of the Nakhchivan Autonomous Republic," 21 species belonging to 6 genera mentioned in the *Crassulaceae* family were preserved.

It should be noted that severe droughts caused by global climate change primarily have a critical impact on plants living in open rocky areas, preventing them from developing normally, and sometimes destroying them (Talibov, 2024). Finally, together with S. Jamalbeyli (Talibov, 2025), the state of research on the *Crassulaceae* family was studied and the results were published.

Taking advantage of the relative calm in the border areas recently, we organized expeditions to the higher peaks of the Soyukdag and Goygol sections of the Zangezur Range on June 10-13, 2025. During the research, we collected a large amount of material on the family from the Kotamdag and Soyukdag ridges, as well as the vicinity of Goygol near Mount Qapichiq, among which the species *Sempervivum montanum* L. and *Sedum acre* L. became new species for the flora of the autonomous republic. Since the species *Sedum acre* L. had not yet bloomed, we collected it and planted it in the laboratory on peas, and after flowering, we compiled its herbarium. As a result, the following 20 taxa belonging to 4 genera were noted on the territory of the autonomous republic:

Ordo: *Saxifragales* Bercht. & J.Presl
Familia: *Crassulaceae* J.St.-Hil.,non. Cons., 1805
Subfamilia: *Sempervivoideae* (Durande) Arn.

Tribus 1: *Semperviveae* Dumort.
1. Genus: *Sempervivum* L., 1754
1(1) *Sempervivum armenum* Boiss. & Huet (*S.glabrifolium* Boriss.)
2(2) *S. caucasicum* Rupr. ex Boiss.
3(3) *S. montanum* L.
Tribus 2: Sedeae Fr.
Subtribus: *Sedinae*
2. Genus: *Sedum* L., 1754
Section 1: *Sempervivoides* Boiss., 1872
4(1) *Sedum sempervivoides* Fisch.
5(2) *S. maximum* subsp. *ruprechtii* (Jalas) Soo [*Sedum caucasicum*(Grossh.) Boriss.]
Section 2: *Telephlum* S.F. Gray
6(3) *S. aetnense* Tineo [*S. tetramerum* Trautv; *Macrocepalum tetramerum* (Trautv.) Palanov]
Section 3: *Sedagenuina* Koch
Subsection 1: *Spathulata* Bor., 1939
7(4) *S. oppositifolium* Sims
Subsection 2: *Crassifoliae* Bor., 1939
8(5) *S. acre* L.
9(6) *S. album* L.
10(7) *S. gracile* C.A. Mey.
11(8) *S. subulatum* (C.A. Mey.) Boiss.
12(9) *S. tenellum* M.Bieb.
Section 4: *Epeteium* Boiss., 1872
13(10) *S. annuum* L.
14(11) *S. hispanicum* L. (*S. pentapetalum* Boriss.; *S. corymbosum* Grossh.)
3. Genus: *Rosularia* (DC.) Stapf
15(1) *Rosularia elymaitica* (Boiss. & Hausskn.) A.Berger
16(2) *R. persica* (Boiss.) A.Berger
17(3) *R. radiciflora* Steud. ex Boriss.
18(4) *R. sempervivum* (M.Bieb.) A.Berger
4. Genus: *Prometheum* (A.Berger) H.Ohba
19(1) *Prometheum pilosum* (Fischer ex M. Bieb.) H.Ohba (*Sedum pilosum* M.Bieb.)
20(2) *P. sempervivoides* (Fisch. ex M. Bieb.) H.Ohba

Conclusion

On the territory of the Nakhchivan Autonomous Republic, special research works on the family Crassulaceae J. St.-Hil. were not carried out, summarizing fragmentary works on the family, we found that on the territory of the autonomous republic, the family is represented by 21 species belonging to 6 genera. Expeditions organized by us on June 10-13, 2025, to the higher peaks of the Soyukdag and Goygol belts of the Zangezur Range collected a large amount of material, among which the species Sempervivum montanum L. and Sedum acre L. became new to the flora of the autonomous republic. As a result of the analysis, we compiled a taxonomic spectrum of the autonomous republic and found that 20 species belonging to 4 genera are widespread in the flora.

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