

Conspectus of Sedoideae (Crassulaceae) of the Russian Far East

Svetlana B. Gontcharova

Botanical Garden-Institute, Far-Eastern Branch of the Russian Academy of Sciences,
Makovskogo str., 142, 690024, Vladivostok-24, Russia

Abstract A conspectus of the subfamily Sedoideae (Crassulaceae) of the Russian Far East is presented. Twenty eight species of the genera *Hylotelephium*, *Aizopsis*, *Rhodiola* and *Orostachys* are listed. Biogeographical data of the species are given. New combinations are made and taxonomy of some species is discussed.

Key words : Sedoideae, *Hylotelephium*, *Aizopsis*, *Rhodiola*, *Orostachys*, taxonomy

Introduction

At the Russian Far East family Crassulaceae is represented by two subfamilies—Crassuloideae (genus *Tillaea* L. with one species *T. aquatica* L.) and Sedoideae (with 4 genera *Hylotelephium* H. Ohba, *Aizopsis* Grulich, *Rhodiola* L. and *Orostachys* Fish., which account for 28 species). The special account of the family representatives of this territory was made by Bezdeleva (1995). This author followed the classical point of view on the taxonomy of Crassulaceae. Modern studies have shown that genus *Sedum* (s.l.) is a very artificial taxon. Many authors call for the necessity of its monophyletic units separation (Grulich, 1984; Egli *et al.*, 1995; Hart 't, 1995, Ohba, 1995). Several attempts to divide the genus on smaller genera were made (Ohba, 1977, 1978, 1995; Grulich, 1984). These authors demonstrated an independence of the genus *Hylotelephium* H. Ohba and raised a new genus *Aizopsis* Grulich, what considerably changed infrafamiliar and infrageneric taxonomy of Sedoideae.

At the present paper a conspectus of the representatives of subfamily Sedoideae of the family Crassulaceae revealed in the Russian Far East is given.

Materials and Methods

Materials for the present study were collected in 1989–1997 at the Primorsky, Khabarovsk, Amursky and Sakhalin Territories (Russian Far East). The specimens from herbaria of Komarov Botanical Institute (LE), Sanct-Petersburg and Institute of Biology and Soil Science (VLA), Vladivostok, Russia, Department of Botany, National Science Museum (TNS), Tokyo, Japan were used. For the study of morphological patterns many species were cultivated at the Botanical Garden Far Eastern Branch of the Russian Academy of Sciences (FEB RAS, Vladivostok). The following con-

spectus is in accordance with the systems of Borissova (1939), Ohba (1978, 1995), Grulich (1984). The arrangement of the species within each section is alphabetical. Distribution of the species within Russian Far East is indicated in accordance with phytogeographical regions of Kharkevich (1985) (fig. 1).

Conspectus of Sedoideae of the Russian Far East

Crassulaceae DC.

Subfam. **Sedoideae** Berger

Genus **Hylotelephium** H. Ohba in Bot. Mag. Tokyo **90**: 46 (1977).

Sedum L., Sp. Pl. ed. 1, 430 (1753), pro parte.

Sedum sect. *Telephium* S. F. Gray in Nat. Arr. Brit. Pl. **2**: 532 (1821).

Sedum subgen. *Telephium* (S. F. Gray) Clausen in *Sedum* N. Amer. **70** (1995).

Sect. **Hylotelephium**

Ser. **Hylotelephium**

–*Sedum* sect. *Telephium* ser. *Erecticaules* Praeger in J. Roy. Hort. Soc. **46**: 78 (1921), cum gr. *Eu-Telephia* Praeger et gr. *Verticillata* Praeger—Berger in Engl. et Prantl, Nat. Pfl.-fam. 2 Aufl. **18a**: 443 (1930).

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Eu-Telephium* (Praeger) Boriss. in Komarov, Fl. URSS **9**: 53 (1939), nom. invalid.

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Eu-Telephium* (Praeger) Boriss. in Nov. Syst. Vyssh. Rast. **6**: 116 (1969).

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Fasciculatae* Boriss. in Komarov, Fl. URSS **9**: 61 (1939), nom. invalid.

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Fasciculatae* Boriss. in Nov. Syst. Vyssh. Rast. **6**: 116 (1969).

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Viviparae* Boriss. in Komarov, Fl. URSS **9**: 58 (1939), nom. invalid.

–*Sedum* sect. *Telephium* subsect. *Erectikaulia* Praeger ser. *Viviparae* Boriss. in Nov. Syst. Vyssh. Rast. **6**: 116 (1969).

Hylotelephium erythrostickum (Miq.) H. Ohba in Bot. Mag. Tokyo **90**: 50 (1977).

–*S. erythrostickum* Miq. in Ann. Mus. Bot. Lugd.-Bat. **2**: 115 (1866).

–*S. alboroseum* Baker in Saund., Refug. Bot. **1**: t.33 (1868).

–*S. telephium* ssp. *alboroseum* (Baker) Fröd. in Act. Hort. Gothobor. **5**: append. 61 (1930).

Distribution in the Russian Far East (RFE): 19.

General distribution: Korea, Japan, Russian Far East and China.

Borissova (1939) indicated that the species occurs in Manchuria, however, it is not included to the Manchurian Floras (Noda, 1971; Kitagawa, 1979).

Hylotelephium pallescens (Freyn) H. Ohba in Bot. Mag. Tokyo **90**: 51 (1977).

–*S. pallescens* Freyn in Oest. Bot. Zeitschr. **45**: 317 (1895).

–*Sedum telephium* var. *pallescens* Kom. in Act. Hort. Petrop. **22**: 393 (1903).

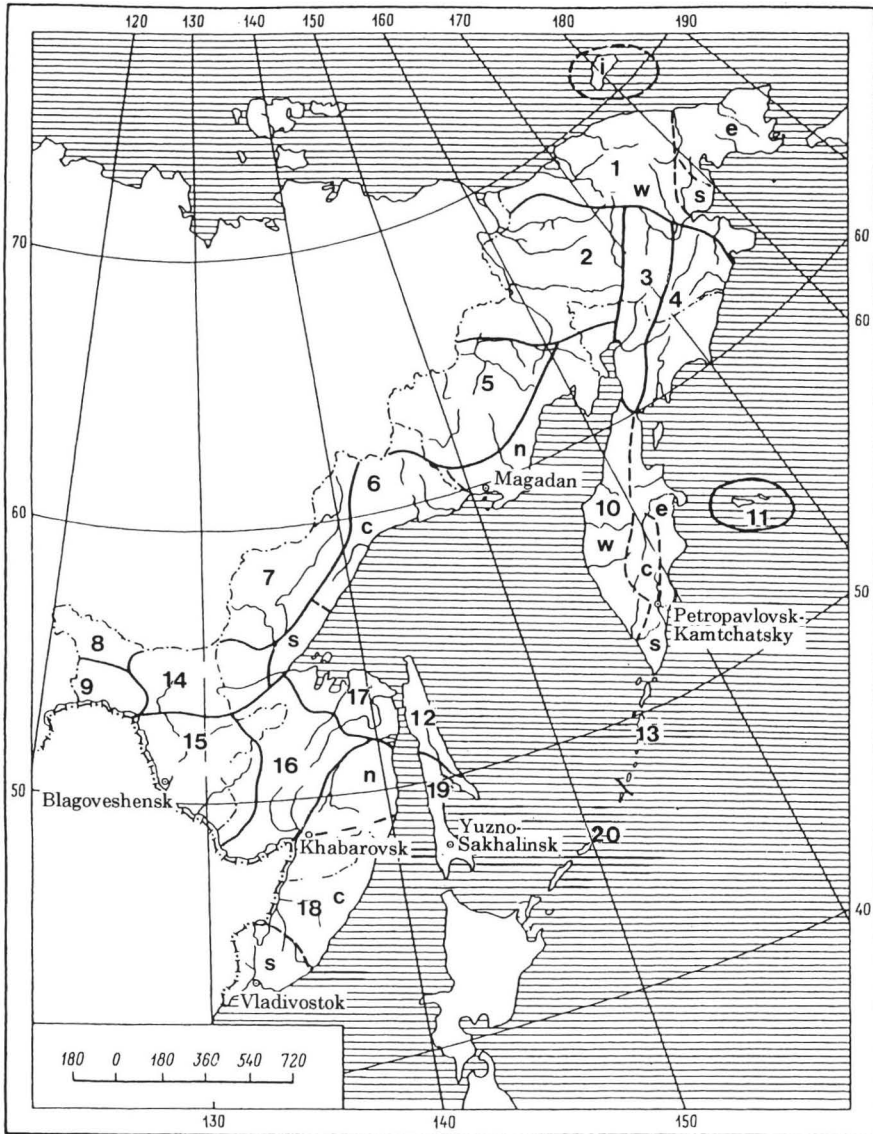


Fig. 1. Map showing phytogeographical regions of the Russian Far East (after Kharkevich, 1985)
 1—Chukotka's region (subregions: i—*island's*, w—*western*, e—*eastern*, s—*southern*); 2—Aniuy's;
 3—Anadir-Penjina's; 4—Koriakia's; 5—Kolima's; 6—Okhotsk's (subregions: n—*northern*, c—*central*, s—*southern*); 7—Aldan's; 8—Niukzha's; 9—Dahuria's; 10—Kamchatka's region (subregions: w—*western*, c—*central*, e—*eastern*, s—*southern*); 11—Komandor's; 12—Nothern-Sakhalin's; 13—
 Northen-Kuril's; 14—Verkhniaya-Zeya's; 15—Nizniaya-Zeya's; 16—Bureya's; 17—Amgun's; 18—
 Ussuri's (subregions: n—*northern*, c—*central*, s—*southern*); 19—South-Sachalin's; 20—South-
 Kuril's.

–*S. eupatorioides* Kom. in Komarov et Alisova, Key Pl. Far East. Region 1: 601 (1931).

–*Hylotelephium eupatorioides* (Kom.) H. Ohba in Bot. Mag. Tokyo 90: 50 (1977).
Distribution in RFE: 9, 14, 15, 16, 17, 18.

General distribution: Western (W) Siberia, Russian Far East and China.

The species was reported as an endemic of the Russian Far East (Borissova, 1939).

Hylotelephium triphyllum (Haw.) Holub, Folia Geobot. Phytotax. 18(2): 204 (1983).

–*Sedum telephium* L. var. *β purpureum* L., Sp. Pl. 430 (1753).

–*Anacampseros triphylla* Haw. Syn. Pl. Succ. 111 (1812).

–*Sedum. purpureum* (L.) Schult. Oester. Fl. ed. 2, 686 (1814).

–*S. telephium* L. subsp. *telephium* Webb. in Tutin et al (eds.), Fl. Europ. 1: 358 (1964).

–*Hylotelephium purpureum* (L.) Holub in Preslia 51: 281 (1979).

Distribution in RFE: 3, 4, 5, 6 (n., s.), 9, 10, 12, 14, 15, 16, 17, 18, 19, 20.

General distribution: Europe, W and Eastern (E) Siberia, Mongolia, China, Korea, Japan (Hokkaido) and Russian Far East.

Hylotelephium verticillatum (L.) H. Ohba in Bot. Mag. Tokyo 90: 54 (1977).

–*S. verticillatum* L., Sp. Pl. 430 (1753).

–*S. telephium* ssp. *verticillatum* (L.) Fröd. in Act. Hort. Gothob. 5: append. 64, figs. 254–259, Pl. 25 (1930).

Distribution in RFE: 10, 12, 19, 20.

General distribution: E Siberia, Russian Far East, China, N Korea and Japan.

Hylotelephium viviparum (Maxim.) H. Ohba in Bot. Mag. Tokyo 90: 55 (1977).

–*S. viviparum* Maxim. in Bull. Ac. Pétersb. 29: 142 (1883).

–*S. telephium* ssp. *viviparum* (Maxim.) Fröd. in Act. Hort. Gothob. 5: append. 65, figs. 260–268, pl. 26 (1930).

Distribution in RFE: 18.

General distribution: Korea, China.

Ser. **Sieboldia** H. Ohba in J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12: 165. (1978).

Hylotelephium ussuriense (Kom.) H. Ohba in Bot. Mag. Tokyo 90: 54 (1977).

–*S. ussuriense* Kom. in Bull. Jard. Bot. Petersb. 16: 170 (1916).

Distribution in RFE: 18.

General distribution: Russian Far East.

This species was reported as an endemic for Ussuri's region (Borissova, 1939; Bezdeleva, 1995; Gontcharova, 1997), however, Ohba (1993) treated *H. tsugaruense* (H. Hara) H. Ohba as Japanese variety of the species concerned.

It was placed in the ser. *Hylotelephium* (Ohba, 1978), however, from my point of view its features more correspond to those of the ser. *Sieboldia*.

Sect. **Populisedum** (Berger) H. Ohba in J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12: 165 (1978).

Sedum sect. *Populisedum* Berger in Engl. et Prantl, Nat. Pfl.-fam. 2 Aufl. **18a**: 446 (1930).

Sedum sect. *Telephium* subsect *Humilikaulia* Praeger ser. *Repentes* (Praeger) Boriss. in Komarov, Fl. URSS **9**: 64 (1939)

Hylotelephium cyaneum (J. Rudolf) H. Ohba. in Bot. Mag. Tokyo **90**: 50 (1977).

–*S. cyaneum* Rud. in Mém. Acad. Sci. Pétersb. **4**: 341 (1811).

–*S. lilacinum* Ledeb. in Mém. Acad. Sci. Pétersb. **5**: 535 (1812).

–*S. dahuricum* Steph. ex Boriss. in Komarov, Fl. URSS **9**: 66 (1939), pro syn.

Distribution in RFE: 1, 2, 3, 5, 7, 10, 12, 16, 17.

General distribution: E Siberia, Russian Far East.

Hylotelephium pluricaule (Kudo) H. Ohba in Bot. Mag. Tokyo **90**: 51 (1977).

–*S. pluricaule* Kudo in J. Coll. Agric. Sapporo **12**: 40 (1923).

–*S. telephium* var. *pluricaule* Maxim. in Bull. Ac. Pétersb. **29**: 142 (1883).

Distribution in RFE: 12, 19.

General distribution: Japan (Hokkaido) and Russian Far East.

In Russian literature this species is treated as an endemic to Sakhalin Island (Borissova, 1939; Bezdeleva, 1995). However, it was reported in Japan also (Ohba, 1977).

Genus **Aizopsis** Grulich in Preslia **56** (1): 35 (1984).

Sedum L., Sp. Pl. ed. 1, 430 (1753), pro parte no 4–5.

Sedum L. sect. *Aizoon* Koch, Syn. Fl. Germ. 259 (1835).

Sedum L. subgen. *Aizoon* (Koch) H. Ohba in J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. **12**: 179 (1978).

Sect. **Aizopsis**

Sedum ser. *Glabra* Boriss. in Komarov, Flora USSR **9**: 67 (1939), nom. invalid.

Sedum ser. *Aizoonta* (Maxim.) Boriss. in Novosty Syst. Vyssh. Rast. **6**: 116 (1969).

Sedum sect. *Genuina* ser. *Aizoonta* Maxim. Bull. Acad. Sci. Pétersb. **29**: 143 (1883).

Aizoopsis aizoon (L.) Grulich in Preslia **56**(1): 37 (1984).

–*Sedum aizoon* L., Sp. Pl. 430 (1753).

–*S. hyperaizoon* Kom. in Bull. Jard. Bot. Ptinc. **30**: 201 (1931).

–*Phedimus aizoon* (L.) ‘t Hart in ‘t Hart & Eggli (eds.), Evol. & Syst. Crassulac. **168** (1995).

Distribution in RFE: 9, 14, 15, 16, 17, 18, 19, 20.

General distribution: W and E Siberia, Russian Far East, Mongolia, Korea, China and Japan.

Aizopsis kamtschatica (Fisch.) Grulich in Preslia **56**(1): 37 (1984).

–*Sedum kamtschaticum* Fisch., Index Sem. Horti Petrop. **7**: 54 (1840).

–*S. aizoon* L. ssp. *kamtschaticum* (Fisch.) Frod. in Acta Hort. Gothob. **6**: append. 79, pl. 46, figs. 604–608 (1931).

–*Phedimus kamtschaticus* (Fisch.) ‘t Hart in ‘t Hart & Eggli (eds.), Evol. &

Syst. Crassulac. 168 (1995).

Distribution in RFE: 2, 3, 4, 5, 6, 7, 9, 10, 12, 16, 17, 18, 19.

General distribution: Korea, Japan, China, Russian Far East.

Aizopsis kurilensis (Vorosch.) S. Gontch., **comb. nov.**

Basionym: *Sedum kurilense* Vorosch. in Bull. Glavn. Botan. Sada. **60**: 39 (1965).

–*S. sikokianum* Maxim. ssp. *kurilense* (Vorosch.) Vorosch. in A. K. Skvortsov (ed.), Florist. issl. v razn. raionakh SSSR: 174 (1985).

Distribution in RFE: 20. Endemic.

General distribution: Russian Far East.

Aizopsis maximowiczii (Regel) S. Gontch., **comb. nov.**

Basionym: *Sedum maximowiczii* Regel in Gartenfl. **528**: 355 (1866).

–Synonyms: *S. aizoon* ssp. *maximowichzii* (Regel) Vorosch. in A. K. Skvortsov (ed.), Florist. issl. v razn. raionakh SSSR: 173 (1985).

–*S. litorale* Kom. in Bull. Jard. Bot. Princ. **30**: 201 (1931).

–*Phedimus litoralis* (Kom.) 't Hart in 't Hart & Eggli (eds.), Evol. & Syst. Crassulac. 168 (1995).

–*Phedimus maximowichzii* (Regel) 't Hart in 't Hart & Eggli (eds.), Evol. & Syst. Crassulac.: 168 (1995).

Distribution in RFE: 18.

General distribution: Russian Far East.

Voroschilov (1982) considered *S. litorale* as a subspecies of *S. aizoon*. I, following Bezdeleva (1995), think that it is a distinct species which is endemic for the Russia Far East.

Aizopsis maximowiczii differentiates from *A. aizoon* in its elliptical opposite or sometimes whorled leaves and orange-coloured flowers (Bezdeleva, 1995; Gontcharova, 1997). The study on the micromorphological and anatomical features of seeds of these species has shown significant difference between them in orientation, degree of fusion, height and type of thickening of the distal anticlinal cell wall of spermoderma, forming longitudinal combs on the seed surface (Abankina & Gontcharova, in press). Moreover, *A. maximowiczii* occurs in the coastal habitats mainly. From my point of view these differences allow to treat it as an independent species.

Aizopsis middendorffiana (Maxim.) Grulich in Preslia **56**(1): 37 (1984).

subsp. **middendorffiana**

–*S. middendorffianum* Maxim., Prim. Fl. Amur. 116 (1859).

–*S. aizoon* L. var. *middendorffianum* (Maxim.) Fröd. in Acta Hort. Gothob. **5**: 80 (1931).

–*Phedimus middendorffianus* (Maxim.) 't Hart in 't Hart & Eggli (eds.), Evol. & Syst. Crassulac. 169 (1995).

Distribution in RFE: 6, 7, 15, 16, 17, 18, 19.

General distribution: W Siberia, Russian Far East, Korea, China.

subsp. **sichotensis** (Vorosch.) S. Gontch., **comb. nov.**

Basionym: *S. sichotense* Vorosch. in Bull. Glavn. Botan. Sada **40**: 51 (1961).

–*S. middendorffianum* Maxim. ssp. *sichotense* (Vorosch.) Vorosch. in A. K. Skvortsov (ed.), Florist. issl. v razn. raionakh SSSR: 174 (1985).

–*Phedimus sichotensis* (Vorosch.) 't Hart in 't Hart & Eggli (eds.), Evol. & Syst. Crassulac. 169 (1995).

Distribution in RFE: 18.

General distribution: Russian Far East.

Many authors do not consider this taxon as distinct and unite it with *A. middendorffiana*, widely distributed in the Russian Far East (Voroschilov, 1982; Bezdeleva, 1995). I agree with Gursenkov (1967) who considered this subspecies as an endemic for southern Sichte-Aline. These two subspecies clearly differentiate in their phenological spectrum and growth forms (Gontcharova, 1996b).

Sect. **Villosae** (Boriss.) S. Gontch., **stat. nov.**

Basionym: *Sedum* ser. *Villosae* Boriss. in Novosty Syst. Vyssh. Rast. **6**: 117 (1969).

–*Sedum* ser. *Villosae* Boriss. in Komarov, Flora USSR **9**: 72 (1939), nom. invalid.

The section is characterized by sympodial-monopodial vegetative innovation, similar to those of the species of the genus *Rhodiola* (Gontcharova, 1997). The section has a distinct phenols composition (Shniakina, 1979). Type of testa's ornamentation is unique and has not found in any *Sedum* (s. l.) species ('t Hart & Berendsen, 1980).

Aizopsis selskiana (Regel et Maack) Grulich in Preslia **56**(1): 37 (1984).

–*Sedum selskianum* Regel et Maack in Regel, Tent. Fl. Ussur. 66 (1861).

–*Phedimus selskianianus* (Regel & Maack) 't Hart in 't Hart & Eggli (eds.), Evol. & Syst. Crassulac. 169 (1995).

Distribution in RFE: 16, 18 (s., c.).

General distribution: N Korea, China and Russian Far East.

Genus **Rhodiola** L.

Subgen. **Rhodiola**.

Sect. **Rhodiola**.

Rhodiola I. *Eu-Rhodiola* Fisch. & C.A Mey., Enum. Pl. Nov. Schrenk **1**: 67 (1841).

Rhodiola sect. *Eu-Rhodiola* (Fisch. & C. A. Mey.) Boriss. in Komarov, Fl. URSS. **9**: 29 (1939).

Rhodiola integrifolia Raf. in Atl. Journ. **1**: 146 (1832).

–*R. rosea* L. var. *integrifolia* (Raf.) E. Murray in Kalmia **12**: 24 (1982).

–*R. atropurpurea* (Turch.) Trautv. & C. A. Mey., Middend. Reise Fl. Ochot. 39 (1856).

–*R. rosea* subsp. *atropurpurea* (Turch.) Jacobsen in Nation. Cact. Succ. J. (U.K.). **28**(1): 5 (1973).

Sedum atropurpureum Turch. in Bull. Soc. Mosc. **1**: 13 (1840).

There are about 30 synonyms of the species. Many authors consider this taxon as a subspecies or variety of *R. rosea*, however, it is distinct from the latter species in the morphology of generative organs (Ohba, 1981) and growth form. Its caudex is not developed, vegetative innovation buds are formed on the risomes.

Distribution in RFE: 1, 3, 4, 6, 10, 13, 18, 20.

General distribution: Siberia, Russian Far East and N America.

Rhodiola ishidae (Miyabe & Kudo) H. Hara in J. Jap. Bot. **13**: 930 (1937).

–*Rhodiola himalensis* (Don) S. H. Fu var. *ishidae* (Miyabe & Kudo) Jacobsen in Nation. Cact. Succ. J. (U.K.) **28**(1): 5 (1973).

–*Sedum ishidae* Miyabe & Kudo in Trans. Sapporo Nat. Hist. Soc. **8**: 3 (1921).

Distribution in RFE: 20.

General distribution: Japan and Russian Far East.

Rhodiola rosea L., Sp. Pl. 1035 (1753).

–*Sedum roseum* (L.) Scop., Fl. Carn. **1**: 326 (1771).

subsp. **rosea**

–*S. Rhodiola* DC., Hist. Pl. Grasses 143 (1805).

About 50 synonyms of the species have been found. Here only some of them are listed. The complete list of the synonyms of the species concerned was given by Ohba (1981).

Distribution in RFE: 1, 2, 3, 4, 6, 7, 8, 10, 12, 14, 15, 16, 17, 18, 19, 20.

General distribution: Arctic, Europe, W and E Siberia, Russian Far East, Central Asia, Mongolia, China, Korea, Japan and N America.

subsp. **krivochizhini** (Sipl.) S. Gontch. **comb. et stat. nov.**

Basionym: *R. krivochizhini* Sipl. in Novosty Syst. Vyssh. Rast. **11**: 313 (1974).

Distribution in RFE: 4.

This subspecies of *Rhodiola rosea* is an endemic of Verkhoturova Island situated at Bering Sea.

General distribution: Russian Far East.

Taxonomic affiliation of *Rhodiola rosea* subsp. *krivochizhini* is not clear yet. Siplivinsky (Krivochizhin & Siplivinsky, 1974) who described it mentioned an affinity of his taxon with *R. atropurpurea*. However, such features as small yellow (not red) flowers and green (not glaucous) leaves differentiate *R. krivochizhini* from *R. atropurpurea*. From my point of view the same characters clearly indicate on the affinities between taxon under consideration and *Rhodiola rosea*.

subsp. **sachalinensis** (Boriss.) S. Gontch., **comb. et stat. nov.**

Basionym: *R. sachalinensis* Boriss. in Komarov, Fl. USSR **9**: 31 (1939).

–*S. sachalinense* (Boriss.) Vorosch., Fl. Sovet. Daln. Vost. 236 (1966).

Distribution in RFE: 12, 19, 20.

The taxon is an endemic for some islands of the Russian Far East. It occurs on coastal habitats only (in sandy and rocky places).

General distribution: Russian Far East.

Ser. **Algida** Boriss. in *Novosty Syst. Vyssh. Rast.* **6**: 114. (1969).

Rhodiola L. sect. *Chamaerhodiola* (Fisch. & C. A. Mey.) Boriss. ser. *Fastigiatae* (Fröd.) S. H. Fu in *Acta Phytotax. Sin. add.* **1**: 120 (1965), pro parte.

Rhodiola angusta Nakai in *Bot. Mag. Tokyo* **28**: 304 (1914).

–*R. komarovii* Boriss. in *Komarov, Flora USSR* **9**: 38 (1939).

–*Sedum polytrichoides* Kom. in *Komarov & Alisova, Oprod. Rast. Dalnevost. kraja* **1**: 601 (1931), non Hemsl.

Distribution in RFE: 18.

General distribution: NE China, Korea and southern regions of the Russian Far East.

Borissova (1939) listed this species for Russia as *R. komarovii*, however, Ohba (1993) had clarified that both species are conspecific.

Sect. **Chamaerhodiola** (Fisch. & C. A. May.) Boriss. in *Komarov, Fl. URSS* **9**: 39. (1939).

Rhodiola II. *Chamae-Rhodiola* Fisch. & C.A. Mey., *Enum. Pl. Nov. Schrenk* **1**: 69 (1841).

Rhodiola sect. *Chamae-Rhodiola* (Fisch. & C.A. Mey.) Boriss. in *Komarov, Fl. URSS* **9**: 39 (1939).

Chamaerhodiola (Fisch. & C. A. Mey.) Nakai apud Nakai & Kitagawa in *Rep. 1st Sci. Exped. Manchoukuo, 1933, Sect. IV. I. (Pl. Nov. Jehol. I.)* 27 (1934).

Ser. **Quadrifidae** (Fröd. ex S. H. Fu) Boriss. in *Novosty Syst. Vyssh. Rast.* **6**: 114. (1969).

Sedum L. sect. *Rhodiola* (L.) Scop. group *Chamaerhodiola* (Fisch. & C. A. Mey.) Fröd. subgroup. *Quadrifidum* Fröd. in *Act. Hort. Gothob.* **15**: 3 (1942), nom. invalid.

Rhodiola ser. *Quadrifidae* (Fröd.) S. H. Fu in *Acta Phytotax. Sin. add.* **1**: 119 (1965), cum *Rhodiola* L. ser. *Dumulosae* S. H. Fu in *Acta Phytotax. Sin. add.* **1**: 119 (1965), cum *Rhodiola* L. ser. *Fastigiatae* (Fröd.) S.H. Fu in *Acta Phytotax. Sin. add.* **1**: 120 (1965), pro parte.

Rhodiola quadrifida (Pall.) Fisch. & C. A. May. in *Schrank, Enum. Pl. Nov.* **1**: 69 (1841).

–*Chamaerhodiola quadrifida* (Pallas) Nakai apud Nakai & Kitagawa in *Rep. 1st Sc. Exped. Manchoukuo, 1933, Sect. IV. I. (Pl. Nov. Jehol. I.)* 29 (1934).

Distribution in RFE: 5, 6, 7, 17, 16.

General distribution: Arctic Europe, Siberia, Mongolia and Russian Far East.

Subgen. **Crassipedes** (Praeger) H. Ohba

Rhodiola stephani (Cham.) Trautv. & C.A. May., *Middend. Reise Fl. Ochot.* **39** (1856).

–*Sedum stephani* Cham. in *Linnaea* **6**: 549 (1831).

–*Rhodiola crassipes* (Wall. ex Hook. f. & Thoms.) Boriss. var. *stephani* (Cham.) Jacobsen in *Nation. Cact. Succ. J. (U.K.)*, **28**(1): 5 (1973)

Distribution in RFE: 6, 17, 16.

General distribution: Russian Far East.

Genus **Orostachys** Fisch. ex Berger in Engler & Prantl, Nat. Pflanzenfam. ed. 2, **18a**: 463 (1930).

Orostachys Fisch., Cat. Jard. Gorenki 99 (1808), nom. nud.

Umbilicus DC. sect. *Orostachys* DC., Prodr. **3**: 400 (1828).

Cotyledon L. sect. *Umbilicus* (DC.) DC. ex Schonland ser. *Orostachys* Schonland, in Engl. & Prantl, Nat. Pflanzenfam. III, **2a**: 33 (1890).

Sedum L. sect. *Asiatica Genuina Orthocarpia* Fröd. gr. *Orostachys* (DC.) Fröd. in Act. Hort. Gothob. **6**: apped. 9 (1931).

Sect. **Orostachys**

subsect. **Orostachys**

Orostachys ser. *Eappendiculatae* Boriss. in Komarov, Flora USSR **9**: 110 (1939), nom. invalid.

Orostachys sect. *Caespitosa* Bezd. in Kharkevich et al (eds.), Sosud. Rast. Sovet. Dal'nego Vostoka **7**: 231 (1995), nom. invalid.

Species composition of the subsection is disputable. Ohwi (1965) united its species, described from northern Japan, *O. aggregata* and *O. furusei*, with *O. iwarenge*. Later Ohba (1990) listed them as subspecies of *O. malacophylla*. I think that there is a confusion in understanding of the continental and islands' (Japanese) species existing in Eastern Asia. Perhaps different species are listed under the same name and their sufficient comparison is needed.

Orostachys aggregata (Makino) H. Hara in Bot. Mag. Tokyo **49**: 73 (1935).

–*O. malacophyllus* var. *aggregatus* (Makino) H. Ohba in J. Jpn. Bot. **67**: 200 (1992).

–*Cotyledon aggregata* Makino in Bot. Mag. Tokyo **24**: 72 (1910).

–*Sedum aggregatum* Makino in J. Jpn. Bot. **4**: 7 (1927).

Orostachys aggregata differentiates with *O. malacophylla* “in small size of all parts and in having short stolones and the aggregated habit” (Makino, 1910, p. 72), linear to oblong petals, follicles not connated pedicellus and purple anthers before dehiscence. One more characters which differentiates these species is a growth form. *O. aggregata* is an obligate polycarpic whereas *O. malacophylla* is facultative polycarpic (Gontcharova, 1996 a).

Ohba (1990, 1992) considers *O. aggregata* as a geographical variety of *O. malacophylla*. From my point of view, *O. aggregata* is distinct from the latter taxon in its ecology, morphology and geographical distribution. In the Russian Far East the species under discussion prefers sea coastal rocky habitats while *O. malacophylla* inhabits stony slopes and river's terraces. Crossing areas and similar morphological nature of these species perhaps are the evidence of their common origination.

Distribution in RFE: 19, 20.

General distribution: Japan (Hokkaido and north Honshu) and Russian Far East.

Orostachys furusei Ohwi in Bull. Nat. Sci. Mus. Tokyo, no 35: 6 (1954).

–*Sedum iwarenge* (Makino) Makino var. *furusei* (Ohwi) Ohwi, Fl. Jap. rev. ed. 1440 (1965).

–*O. vyschinii* Besd. in Kharkevich et al (eds.), Sosud. Rast. Sovet. Dal'nego Vostoka 7: 232 (1995), **syn. nov.**

The species is characterized in obligate glaucous, long branched stolones and numerous rosettes (up to 100). It is an obligate polycarpic chamaephyte, developing mats covering the ground. From other species of the subsection it differentiates in smaller size (rosette 1–2 cm in diameter, leaf 1.5 (2) cm in length, 0.7–1 cm in width), broadly obovate with short stipe folicles and broad, connated folicles' pedicels, yellow anthers before dehiscence and orange ones after dehiscence.

It was described from Rebun Island, northern Hokkaido. We collected this species at the southern part of Sakhalin Island (Tonino-Anivsky Peninsula) and Moneron Island (Abankina & Gontcharova, 1995).

Distribution in RFE: 18, 19.

General distribution: Japan, Russian Far East.

Orostachys iwarenge (Makino) H. Hara in Bot. Mag. Tokyo 49: 73 (1935).

–*Cotyledon iwarenge* Makino in Bot. Mag. Tokyo 16: 142 (1902)

Orostachys malacophylla var. *iwarenge* (Makino) H. Ohba J. Jpn. Bot. 67: 200 (1992).

Makino (1902) indicated that herbarium specimens of *O. iwarenge* and *O. malacophylla* are hardly distinguished and frequently confounded. However, in the wild condition *O. iwarenge* differentiates from the latter species in a stoloniferous branched stems and branched inflorescence, oblong-spathulate or lanceolate-spatulate leaves with obtuse apices, narrowly oblong petals with rounded apices, oblong or broadly-lanceolate sepals, short pedicellate folicles and pink anthers.

In the Russian Far East this species occurs exclusively along coastal regions.

Ohba (1990) mentioned that all species of subsect. *Orostachys* form stolones in cultivation, however, I have never seen it in *O. iwarenge* cultivated in the Botanical Garden of FEB RAS.

Distribution in RFE: 18 (s).

General distribution: Japan, Russian Far East.

Orostachys malacophylla (Pall.) Fisch., Cat. Hort. Gorenk. 99 (1808).

–*Cotyledon malacophylla* Pall., Reise Itin. 3: 729. (1776)

–*Sedum malacophyllum* (Pall.) Stend., Nomencl. Bot. 759 (1821).

–*Umbilicus malacophyllus* (Pall.) DC., Prodr. 3: 400 (1828).

Distribution in RFE: 9, 14, 15, 16, 17, 18, 19.

General distribution: W Siberia, Russian Far East, Mongolia, Korea, Japan, China.

Subsect. **Appendiculatae** (Boriss.) H. Ohba in J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12: 160 (1978).

Sect. *Armato-Appendiculata* Boriss. in *Novosti Syst. Vyssh. Rast.* **6**: 119 (1969).

Sect. *Appendiculata* Boriss. in Komarov, *Fl. USSR* **9**: 110 (1939), nom. invalid.

Orostachys japonica (Maxim.) Berger in *Pflanzenfam.* ed. 2: **18a**: 462 (1930).

–*Cotyledon japonica* Maxim. in *Bull. Acad. Pétersb.* **30**: 122 (1883).

–*Cotyledon minuta* Kom. in *Act. Hort. Petrop.* **18**: 436 (1901).

Orostachys erubescens (Maxim.) Ohwi in *Acta Phytotax. Geobot.* **9**: 249 (1942), non Maxim.

–*O. erubescens* (Maxim.) Ohwi var. *japonicus* (Maxim.) Ohwi, *Fl. Jap.* 586 (1953), non Maxim.

–*Sedum erubescens* (Maxim) Ohwi var. *japonicus* (Maxim) Ohwi, *Fl. Jap.* ed. **2**: 693 (1965), non Maxim..

–*O. cartilaginea* Boriss. in Komarov, *Flora USSR* **9**: 112 (1939).

Distribution in RFE: 18.

General distribution: Korea, Japan, China and Russian Far East.

Bezdeleva (1995) treated *O. japonica* as a synonym of *O. erubescens*. I followed Maximowich (1866–1893), the author of the both species, who considered *O. erubescens* as a synonym of *O. spinosa* (as *Cotyledon spinosa*).

Orostachys spinosa (L.) C. A. May. in *Ledeb., Reise* 496 (1830).

–*Cotyledon spinosa* L., *Sp. Pl.* 429 (1753).

–*Sedum spinosum* (L.) Thunb., *Fl. Jap.* 186 (1784).

–*Umbilicus spinosus* (L.) DC., *Prodr.* **3**: 400 (1828).

–*U. erubescens* Maxim. *Prim. Fl. Amur* 114 (1859).

Distribution in RFE: 5, 6, 7, 8, 9, 14, 15, 16, 17, 18.

General distribution: Europe, W and E Siberia, Russian Far East, Central Asia, Mongolia, Tibet, Japan and China.

Phytogeography of Russian Far Eastern Sedoideae (Crassulaceae)

The representatives of the subfamily are widely distributed within North Hemisphere, in the temperate and subtropical regions of Eurasia mainly. More than 600 species occur in the Old World. There are three regions within subfamily area which have the highest species diversity—Eastern Asia (Eastern-Himalayan), Mediterranean (Irano-Turanian) and North American. As was marked by V. Grulich (1984), processes of speciation were independent within each region.

The subfamily *Sedoideae* is especially diverse in the Eastern Asian floristic region (about 200 species). Comparing species lists of Crassulaceae of European, Western and Eastern Asian floras (Borissova, 1939; Ohwi, 1965 and others), I can assume that only 3 to 5 species are common to these territories and that Eastern Asian representatives of *Sedoideae* are clearly geographically separated from the others. Species of the subfamily occurring in the Russian Far East may originate from Eastern-Himalayan center of their diversity.

The area of genus *Aizopsis* mainly covers Eastern Asian floristic region with the exception of *A. aizoon* and *A. middendorffianum* which spread into the Central and Northern Siberia. Species of the genus *Hylotelephium* are distributed more widely and occur in the Old and New Worlds, however, among Russian Far-Eastern species of the genus only *H. purpureum* spreads throughout entire North Hemisphere. *H. cyaneum*—the only species of the Far-Eastern *Hylotelephium*, which occurs in the Arctic but the main part of its area is in the Central and Eastern Siberia and Eastern Asia. *H. pallescens* occurs from the Baikal Lake to the Far-East.

The species of the genus *Rhodiola*, recorded in the Russian Far East, have a similar pattern of distribution and occur in Eastern Asian floristic region mainly. As was noted by Ohba (1989), among 50 species of the genus concerned, 44 species are recorded in the mountain regions from Pamir up to SW China. Two species (*R. rosea* and *R. integrifolia*) are spread into the arctic and subarctic areas of Eurasia and N America.

Rhodiola rosea is the most widely distributed species within the genus. It spreads to the arctic regions, Alps and other highlands of Europe, Eastern Asia and eastern regions of N America. *R. integrifolia* is distributed in the north-western regions of Siberia, Far East and western regions of N. America, “where *R. rosea* is vacant excepting Siberia” (Ohba, 1989, p. 127).

Far-Eastern species of subsection *Appendiculata* of genus *Orostachys* are widely spread in Siberia and Far East. Among them only *O. spinosa* occurs from the Europe to Pacific coasts. The area of the subsection *Orostachys* is limited to Eastern Asia, except *O. malacophylla* which occurs in Eastern Siberia also.

The main portion of species of the subfamily under discussion has areas in NE China, Korean Peninsula, Primorsky Territory, Sakhalin and Japan.

Acknowledgement

This work has been carried out in the Department of Botany, National Science Museum, Tokyo, permitted as a Foreign Researcher by Director-General of the Museum, to whom I wish to express my hearty thanks. My thanks are due to Dr. Kadota (Department of Botany, National Science Museum) for critically reading the manuscript and valuable suggestion and comments, Dr. V. A. Nedoluzhshko (Botanical Garden FEB RAS, Vladivostok) for his guidance. I am greatly indebted to all staff of the Department of Botany, National Science Museum, for their hospitality during my work there.

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Index to New Combinations Appearing in This Paper

Genus **Aizopsis** Grulich sect. **Villosae** (Boriss.) S. Gontch. **stat. nov.**

Aizopsis kurilensis (Vorosch.) S. Gontch., **comb. nov.**

Aizopsis maximowiczii (Regel) S. Gontch., **comb. nov.**

Aizopsis middendorffiana (Maxim.) Grulich subsp. **sichotensis** (Vorosch.) S. Gontch., **comb. nov.**

Rhodiola rosea L. subsp. **krivochizhinii** (Sipl.) S. Gontch. **comb. et stat. nov.**

Rhodiola rosea L. subsp. **sachalinensis** (Boriss.) S. Gontch., **comb. et stat. nov.**

