

## **Typification of plant names in Suaedoideae (Chenopodiaceae) published by P. Pallas, C. A. Meyer and A. Bunge**

Authors: Lomonosova, Maria, and Freitag, Helmut

Source: Willdenowia, 41(2) : 217-229

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: <https://doi.org/10.3372/wi.41.41202>

---

BioOne Complete ([complete.BioOne.org](https://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](https://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

MARIA LOMONOSOVA<sup>1</sup> & HELMUT FREITAG<sup>2\*</sup>

## Typification of plant names in *Suaedoideae* (*Chenopodiaceae*) published by P. Pallas, C. A. Meyer and A. Bunge

### Abstract

Lomonosova M. & Freitag H.: Typification of plant names in *Suaedoideae* (*Chenopodiaceae*) published by P. Pallas, C. A. Meyer and A. Bunge. – Willdenowia 41: 217–229. December 2011. – Online ISSN 1868-6397; © 2011 BGBM Berlin-Dahlem.

Stable URL: <http://dx.doi.org/10.3372/wi.41.41202>

Lectotypes have been designated for 14 species names referable to *Suaedoideae*. Lectotypes for *Alexandra lehmannii*, *Belowia paradoxa*, *Schanginia inderiensis*, *Schoberia acuminata*, *S. dendroides*, *S. glauca*, *S. leioperma*, *S. microsperma*, *Suaeda baccifera*, *S. linifolia* and *S. physophora* have been selected from the Herbarium of the Komarov Botanical Institute, St Petersburg (LE), for *Schoberia transoxana* and *Suaeda arcuata* from the Herbarium of the Museum National d'Histoire Naturelle, Paris (P), and for *Suaeda microphylla* from the Herbarium of the Natural History Museum, London (BM). In order to present a complete synopsis of the *Suaedoideae* species names published by Pallas (7 names), Meyer (5 names) and Bunge (11 names), the dispersed previous typifications are also included in an abbreviated way and commented as far as required.

Additional key words: *Alexandra*, *Belowia*, *Bienertia*, *Borszczowia*, *Schoberia*, *Schanginia*, *Suaeda*, lectotype, Eurasia

### Introduction

When studying the Eurasian species of subfamily *Suaedoideae* Ulbr., a most intricate group of the *Chenopodiaceae*, typification of species names became necessary to fix their usage. A good number of species of this subfamily were described by P. Pallas, C. A. Meyer and A. Bunge. According to our knowledge and IPNI (2011), seven species names were validly published by P. Pallas (1803), five by C. A. Meyer (1829a, b, 1831a, b) and eleven by A. Bunge (1833, 1835, 1843, 1852, 1878, 1879a, b).

Hitherto 9 out of the 23 names of *Suaedoideae* species published by these authors already have been typified correctly at various places. For the sake of completeness, these typifications are cited here in an abbreviated

way and annotated as far as necessary. In some other cases, previous attempts by Iljin (1936) do not constitute effective typification. Iljin (1936), in his almost monographic treatment of *Chenopodiaceae* in the Flora SSSR, mentioned, in accord with the editorial policy, the type localities and the herbaria where he assumed the original material to be preserved for most names accepted by him. According to the Vienna Code (McNeill & al. 2007) and contrary to the view of Gubanov & al. (1998), Iljin did not cite individual specimens. The information given by Iljin is particularly inaccurate for the species described by Pallas. Led astray by Litvinov (1909), who stated that Pallas had sold all his “main types” to the Natural History Museum London (BM) while only scattered and poorly labelled duplicates have remained at St Petersburg (LE),

1 Central Siberian Botanical Garden, Siberian Branch of the Russian Academy of Sciences, 630090, Novosibirsk, Russia; e-mail: [mlomonosova@mail.ru](mailto:mlomonosova@mail.ru)

2 Plant Taxonomy and Morphology, Institute of Biology, University of Kassel, 34132 Kassel, Germany; \*e-mail: [hfreitag@uni-kassel.de](mailto:hfreitag@uni-kassel.de) (author for correspondence).

he usually combined the distribution data from the protologue with a reference to that herbarium. Our own experience with the collections in LE, however, confirms the statement by Belyaeva & Sennikov (2008) concerning *Salix* that obviously at least the specimens of Pallas's first set are mostly in LE and only exceptionally in BM. But the Pallas specimens are still widely scattered among the collections in LE.

We studied the original material of Pallas in both St Petersburg (LE) and London (BM), where according to Miller (1970), Sytin (1997) and Belyaeva & Sennikov (2008) the main Pallas collections are housed. We also checked the smaller lots in Liverpool (LIV) and Berlin (B) and inquired about relevant Pallas material in Cambridge (CAM) and Oxford (OXF), but with negative results.

Corroborating the information given by Staffleu & Cowan (1981), we found most specimens of C. A. Meyer's original herbarium in LE and did not search particularly for the scattered duplicates elsewhere. Regarding Bunge's original collection, Lipschitz (1947), Staffleu & Mennega (1995) and Borodina-Grabovskaya (2007) stated that a large part is kept in LE, but a very considerable set was acquired by Cosson and is now preserved in Paris (P). We studied the relevant collections in LE and P, but we admit that a few more duplicates of the original material kept in other herbaria might have escaped our attention.

We met the challenge that on some sheets elements collected at different times and places were mounted together. Obviously, sometimes that was done intentionally to show different phenological stages of a species, as, e.g. in *Schoberia glauca* where Bunge explicitly noted on the respective label "...lectis mixta", or in *Suaeda physophora* Pall. where branches in early flowering and in full fruiting stage were assembled with one common label (BM, LE). To meet the requirements of the Code, Art. 8.2 (McNeill & al. 2007) we tried as much as possible to disentangle them but in a few cases we were unable to decide if the separate branches were taken from the same individual or at least from the same location.

## Results

In this paper, the 13 validly published names by Pallas, Meyer and Bunge that have not or not correctly been typified are listed alphabetically for each author together with the names already typified, the latter printed in petit. The currently accepted name, either being the typified name, or a homotypic or heterotypic synonym of it, is given in bold face. Relevant information is provided in the following order: original name, homotypic synonyms, type location as indicated in the protologue, lectotype and existing isolectotypes or syntypes and epitypes, heterotypic synonyms, additional notes.

Pallas (1803) validly described two more species of *Suaeda* that later have been transferred to subfamily *Camphorosmoideae*, viz. *S. sieversiana* Pall. = *Bassia sieversiana* (Pall.) A. A. Weber, nowadays usually included

in *B. scoparia* (L.) A. J. Scott, and *S. albida* Pall. = *Spirobassia hirsuta* (L.) Freitag & G. Kadereit. A few new combinations of taxa by Pallas under *Suaeda* now also classified in *Camphorosmoideae* are not dealt with.

## Species described by P. S. Pallas

**1. *Suaeda baccifera* Pall., Ill. Pl.: 48, t. XLI. 1803.**  
[Ukraine], "Copiose inveni ad Samaram Borysthenis fluvium [Dnepr], in salsuginosis, sub finem septembris Ai. 1795, quum in Chersonesum Tauricam tendebam".  
Lectotype (designated here): [without date and location] "Autumno sero" (LE!, the two plants on the right only; Fig. 1); putative syntype: P!  
= ***Suaeda acuminata*** (C. A. Mey.) Moq.

*Notes.* — According to Iljin (1936) the type should be in London (BM) but we did not find any original material there. The search in LE yielded one sheet with the printed slip "?Isotype" carrying three plants and a label with four lines written by two different hands. The lower and obviously older lines read "Autumno sero" (late autumn) and the upper "Forte haec *Suaeda baccifera* Pall.". While the label and the lower two lines according to the style of handwriting and the ink most likely came from Pallas (a view also expressed by N. N. Tzvelev and A. Sennikov, pers. comm.), the upper two lines probably are a later curatorial note, possibly from Litvinov, restoring the identification that was missing in the original text (A. Sennikov, pers. comm.).

Two of the three plants on the sheet fit Pallas's description and match the drawing, but a later inspection of the specimen (by ML) has shown that the left-hand plant actually belongs to *S. salsa*. A specimen in the Moquin herbarium in P cited by Moquin (1840: 160) under *Chenopodina baccifera* Moq. obviously also represents original material. It is from the herbarium Delessert and consists of two short branches, which are densely beset with the typical large, spongy and almost globular fruits. Three labels on the sheet are from Moquin. Two of them give the type locality: "Borysthen." or "ad Samaram Boristenis".

Despite of missing location and date we choose the specimen in LE as lectotype. The generally agreed synonymisation of *Suaeda baccifera* with *S. acuminata* is in need of reconsideration. Following up Tzvelev (1993), we started relevant studies that also included the identity of *S. confusa* Iljin and *S. eltonica* Iljin. In cultivation experiments with material from Astrakhan and Kazakhstan carried out in Kassel and Novosibirsk, we found that offspring from typical plants with spongy fruiting perianth looks exactly like regular *S. acuminata*.

**2. *Suaeda chenopodioides* Pall., Ill. Pl.: 56. 1803, nom. illeg. = *Chenopodium maritimum* L. = ***Suaeda maritima*** (L.) Dumort.**

*Notes.* — *Suaeda chenopodioides* is an illegitimate replacement of the earlier legitimate name *Chenopodium*





Fig. 1. *Suaeda baccifera* Pall. – type sheet at St Petersburg (LE). The two right-hand plants have been chosen as lectotype, while the left plant belongs to *S. salsa* (L.) Pall. – Photo by M. Lomonosova.

*maritimum* and thus automatically typified by the type of the latter name. Nevertheless, a comment is given about Pallas's putative intention and material. In spite of its identification with *C. maritimum* in the protologue, the material so named by Pallas is not identical with the latter species from the European coasts, which extends to the eastern shores of the Baltic Sea. *S. chenopodioides* is the only species described by Pallas without an accompanying image. It was included into *S. prostrata* by Iljin (1936) without any indication about the type but our search resulted in the discovery of a seemingly original element in BM. It consists of a large, richly branched plant with flower buds that nicely matches the description. Obviously the plant came from cultivation, and a remark in the protologue says the species was grown in a greenhouse. On the backside it is flagged as "Herb. Pallas", and on the upper left a label is fixed with the somewhat strange phrase in Cyrillic "Zalzola khenopodioides – U nas' v kataloge net" [*Salsola chenopodioides*, absent from our catalogue, with the translation given on a slip by P. Tomšovic]. The label must have been attached by one of Pallas's collaborators in St Petersburg. However, the name "*Salsola chenopodioides*" has never been published by Pallas. We assume that it is a provisional name used before he realised that the species in fact belongs to *Suaeda*, as he did in other species, e.g. *S. physophora* that originally was named *Chenopodium physophorum*. The absence from Pallas's catalogue supports the interpretation that the plant has not been collected in nature although its distribution is given in the protologue as "In salsis etiam borealibus; circaque maris littoral et lacuum salsorum ripas ubique provenit haec planta, usque in orientalem Sibiriam". Identification of a *Suaeda* specimen in this early phenological stage is difficult. However, *S. maritima* can be excluded by the distinctly apiculate leaves. The specimen comes closest to *S. prostrata*.

### 3. *Suaeda crassifolia* Pall., Ill. Pl.: 54, t. XLVI. 1803.

"Specimina huius plantae in littore Turcomanico et Persico maris Caspii legit S. G. Gmelin, in nostra ora non occurit".  
Lectotype (designated by Freitag & Lomonosova 2006: 23): [Iran], Gilan [prov.], *S. G. Gmelin* (LE!).

*Note.* — Freitag & Lomonosova (2006: 23, fig. 2) provided detailed information concerning their choice, an image of the lectotype included.

### 4. *Suaeda linifolia* Pall., Ill. Pl.: 47, t. XL. 1803.

[Russia, Volgograd prov.], "Ad rivum salsum Charasacha in lacum Eltoniensem e deserto defluentem, ubi in humidis crescit copiosissime".

Lectotype (designated here): Ad Charasacha salsi rivum in Eltoniensem lacum influentem" (LE!, Fig. 2).

*Notes.* — We found a good specimen of *Suaeda linifolia* in LE that bears Pallas's handwritten label cited above. On another label "*Suaeda linifolia* Pall. sp. auth. v. Pall. Illustr. p. 47" is written in Litvinov's hand. He also added

"Pallas" centrally on the bottom of the sheet. A slip "Iso-typus ?" was attached by V. Grubov at 13.1.1964. The specimen fulfils all requirements of a lectotype and is chosen as such.

### 5. *Suaeda microphylla* Pall., Ill. Pl.: 52, t. XLIV. 1803.

[Dagestan], "Tantum ad rivum salsum Gorkaja inter Cuman et Terec fluvios".

Lectotype (designated here): "Gorkaja retschka" (BM 000040920!).

*Note.* — The location of the "type" was given by Iljin (1936) as London. In this case our search in LE was unsuccessful, but we found in fact one specimen in BM. It includes two branches with flower buds and in the upper left corner a label with the location in Pallas's hand. A text at the bottom of the sheet stems from a later date and reads "*Chenopodina microphylla* Moq., *Suaeda microphylla* Pall. Illustr. Plant." A more recent label by an unknown author is attached between the plants with the designation "Type specimen. *S. microphylla*" and refers further on the relevant nomenclatural data. As that designation obviously has not been published yet, the specimen is designated here as the lectotype of the name *S. microphylla*.

### 6. *Suaeda physophora* Pall., Ill. Pl.: 51, t. XLIII. 1803.

[Former Russian part of Caspian desert], "Inter *Suaedas fruticosa* species passim occurit in salsuginosis, etiam siccis, deserti Caspici; a latere Persico major".

Lectotype (designated here): *Chenopodium physophorum* M. *Suaeda* Pall. (Habet pro *Salsola fruticosa* Linn. Pall.). Ex Sibiria. Pall. (LE!, [right-hand plant only; Fig. 3]); isolectotype: BM 000040917! (right-hand plant only); syntypes: LE (2!), BM (1!).

*Notes.* — Following Iljin (1936) we expected the type in London but we also found original material in LE, with one specimen having the printed slip "M. Iljin. Notae criticae" and the handwritten addition "*Suaeda physophora*". That specimen bears one complete branch system (33 × 10 cm) with flower buds, one separate infructescence and a handwritten label by Bieberstein that obviously refers to both plants, indicating that the sheet was in his possession. However, Bieberstein certainly had obtained the specimen from Pallas. Most likely the drawing in the protologue (t. XLIII) was made from this specimen with the two branches having changed their place by the printing procedure. It was tempting to designate it in its entity as the lectotype. However, by closer inspection we detected that leaves and young stems of the left plant are rough by a dense papillose indumentum, whereas the right plant is glabrous. Furthermore, the different phenological stages clearly indicate that they were collected at different times and most likely from different places. The second sheet in LE contains one plant and a label written in Pallas's hand "*Sals. frutescens*. In siccis squallibus deserti australioris, cum *Halimo* et *Statice suffruticosa*."





Fig. 2. *Suaeda linifolia* Pall. – type sheet at St Petersburg (LE). – Photo by M. Lomonosova.





Fig. 3. *Suaeda physophora* Pall. – type sheet at St Petersburg (LE). The right-hand plant is selected as lectotype because it has glabrous surfaces and well-developed fruits; the left-hand plant was collected at a different location, shows densely papillose surfaces and is the holotype of var. *papillosa* described in the Appendix. – Photo by M. Lomonosova.

Pallas". The plant is completely smooth. In BM we found one sheet containing two branches, again with differing surfaces and representing different phenological stages. Except for the slip "Herb. Pallas" at the top it only bears later annotations.

Taking into account the differing characters of the original elements, the importance of fruits in the taxonomy of the genus and our experience that papillose forms are rare in *Suaeda physophora*, we have chosen the right-hand plant from the first specimen in LE as lectotype though it is the smaller one. The left-hand branch is described by the second author in the Appendix as the new variety *S. physophora* var. *papillosa*.

**7. *Suaeda prostrata*** Pall., Ill. Pl.: 55, t. XLVII. 1803. "In salsuginosis circa rivum Solenka in Jeruslan fluv. tendentem, et inter fortalitia Zarizyn [Volgograd] et Tschernojarsk". Lectotype (Freitag & Lomonosova 2006: 29): [icon.] Pall., Ill. Pl.: t. XLVII; epitype (Freitag & Lomonosova 2006: 29): SE European Russia, Saratov prov., Yeruslan river valley near Dyakovka, c. 7 km below mouth of river Solyanka, alkaline meadows, in eroded patches with *Camphorosma songorica* community, 27.9.1996, H. Freitag 28.312 (KAS; isoeotypes: B, C, E, JE, K, KAS, LD, MHA, MW, NS, TK, W).

*Note.* — Freitag & Lomonosova (2006: 29, fig. 5) provided detailed information concerning their choice, an image of the lectotype included.

### Species described by C. A. Meyer

**1. *Schoberia acuminata*** C. A. Mey. in Ledebour, Fl. Alt. 1: 398. 1829 ≡ *Suaeda acuminata* (C. A. Mey.) Moq. "Hab. sat frequens in regionibus occidentalibus deserti soongoro-kirghisici, locis salsis subhumidis (M.)" Lectotype (designated here): [W China, Dzungaria], *Chenopodium* 193 in locis salsis deserti Trans-Irtisch [coll. C. A. Meyer] (LE!).

*Note.* — This lectotype was already selected by Freitag (2001: 121) but without the phrase "designated here", which became obligatory for publications dating from 1 January 2001 onwards. LE also keeps three original specimens that should be treated as syntypes as they are from another locality. The first specimen has the label "Herb. Ledebour *Schoberia acuminata* m. Altai", with the species name written by Ledebour. The second sheet has a label in Meyer's hand "*Sch. acuminata* Meyer. In salsis humidis, Altai" and the third specimen from Turczaninow's herbarium is labelled "*Sch. acuminata* C. A. M. Altai, in locis salsis".

**2. *Schoberia corniculata*** C. A. Mey. in Ledebour, Fl. Alt. 1: 399. 1829 ≡ *Suaeda corniculata* (C. A. Mey.) Bunge "Hab. in locis subsalsis circa metallifodinam Loktevsk (L.); similibus locis ad fl. Tschuja (B.); nec non prope fortalitium Ssemipalatinsk (M.)". Lectotype (designated by Lomonosova & al. 2008: 91): Altai, in locis salsis, C. A. Meyer (LE [left and central branches only]).

*Note.* — Lomonosova & al. (2008: 91, fig. 7) provided detailed

information concerning their choice, including an image of the lectotype, and the taxonomy of the *S. corniculata* group.

**3. *Schoberia dendroides*** C. A. Mey., Verz. Pfl. Casp. Meer: 159. 1831 ≡ *Suaeda dendroides* (C. A. Mey.) Moq. [Dagestan to Azerbaijan], "Frequens in campis et collibus argilloso-salsis a Derbend, orientem versus, usque ad fluvium Cyrum; in borealioribus autem plane deest". Lectotype (designated here): [Azerbaijan, near Baku], *Schoberia microphylla*. In campis et collibus subsalsis frequens, 29.4. 1830/*Schoberia dendroides* [C. A. Meyer] (LE!; Fig. 4); isolectotypes: LE(2!).

*Notes.* — Iljin (1936) referred to the type in LE, where we found three specimens of *Schoberia dendroides* belonging to Meyer's original material. The first sheet bears seven branches, which might come from one plant, and two labels in Meyer's hand as cited above. According to the preface by Meyer (1831a), this unnamed locality is situated close to Baku (on the third day after they left Baku). The second specimen from Fischer's herbarium and the third one from Bieberstein's herbarium contain identical labels "*S. dendroides*. Enum. cauc. casp. No 1407. Meyer", which most likely were added later by Bunge for the purposes of filing and distribution. We have chosen the first specimen in LE as the lectotype since it is the only one with original labels carrying a phrase of the protologue.

**4. *Schoberia leiosperma*** C. A. Mey. in Ledebour, Icon. Pl. 1: 11, t. 45. 1829. [SE Kazakhstan], "In littore sabuloso humido rivuli Tschaganka ad radicem montium Tschingistau deserti soongoro-kirghisici occidentalis (M.)" [Meyer]. Lectotype (designated here): 304, in sabulosis humidis subsalsis ad rivuli Tschaganka montium Tschingis-tau, d. 14 August [C. A. Meyer] (LE!). = *Suaeda altissima* (L.) Pall.

*Notes.* — Only one original element suitable for typification was found. This sheet in LE bears three plants and three labels in Meyer's hand: One with a morphological description that fully agrees with the protologue, a second with locality and collecting date only and a third one with a drawing corresponding to t. 45 in Ledebour (1829). Later a label "Specimen authenticum" and the printed determination slip "*Suaeda altissima* (L.) Pall., teste M. M. Iljin" were attached. We designate this specimen as the lectotype of *Schoberia leiosperma*.

**5. *Schoberia microsperma*** C. A. Mey. in Eichwald, Pl. Nov. 1: 14, t. XIII. 1831 ≡ *Suaeda microsperma* (C. A. Mey.) Fenzl [Turkmenistan], "In littore orientali caspii maris, prope Krasnowodsk inque insula Dagada". Lectotype (designated here): 162, ad littora maris Caspii prope Alawersk, Krasnovodsk et in insula Dagada, in sinu Balchasch. Dr. Eichwald (LE!).





Fig. 4. *Schoberia dendroides* C. A. Mey. ( $\equiv$  *Suaeda dendroides* (C. A. Mey.) Moq.) – type sheet at St Petersburg (LE). The seven branches and fragments are all considered as parts of the lectotype. – Photo by M. Lomonosova.

*Notes.* — As mentioned by Iljin (1936), the type is kept in LE. It was later annotated as “Typus” of *Schoberia microsperma* by V. Botschantzev. The sheet contains one complete plant and three separate branches, together with two envelopes with fragments and two labels in Meyer’s hand. The first label shows a morphological description that matches the protologue. The second one lists different localities with only two of them cited in the protologue. The itinerary (Eichwald 1831: 6–7) does not give any additional information and in the included enumerations the new species seems to be hidden among “*Schoberia maritima* Mey.”. Therefore, and taking into account the homogeneous characters of the material, we only can designate the collective specimen as the lectotype.

### Species described by A. Bunge

**1. *Alexandra lehmannii*** Bunge in *Linnaea* 17: 120. 1843 ≡ *Suaeda lehmannii* (Bunge) Kapralov & al. [W Kazakhstan], “In deserto Aralensi legit”. Lectotype (designated here): Alexandri Lehmann Reliquiae Botanicae No. 1151. Desert Aralens. *Al. Bunge* (LE!); syntypes: P (2, mounted on one sheet!).

*Notes.* — Iljin (1936) stated LE as the place where the type is preserved. Here we found an original sheet but another one was detected in P. The specimen in LE contains one plant and Bunge’s printed standard label of A. Lehmann’s collection, which bears the number and determination in Bunge’s hand. The sheet in P bears two plants with two original but differing labels. Below the left-hand plant is a label similar to that in LE, but without number and locality. The right-hand plant is labelled in Bunge’s hand “*Alexandra Lehmannii* m. desert. Songar. Bunge”. At the bottom of both labels are notes probably written by a staff member of P and labels of “Herb. Mus. Paris”. For lectotypification we prefer the specimen in LE since the location given on its label perfectly matches the protologue. The specimens in P are considered as syntypes because later the author (Bunge 1852: 287) cited two different gatherings of Lehmann’s collector Ssyssow though from the same area, “In der Aralsteppe genannt Barssuki an Salzseen Juli und Sept. 1840 (Ssyssow) (fruct.)”. Kapralov & al. (2006) noted that the “holotype” is kept in LE, but gave no particulars. They obviously did not see the material and relied on Iljin.

Recognition of this species as a monotypic genus *Alexandra* appears to be more adequate than inclusion in *Suaeda* because of its many apomorphies (see Schütze & al. 2003: 284). This would, however, make *Suaeda* paraphyletic. Acceptance of paraphyletic taxa in plant systematics is an issue still under debate (see, e.g. Hörandl & Stuessy 2010).

**2. *Belowia paradoxa*** Bunge, *Beitr. Fl. Russl.*: 462 (286). 1852 ≡ *Suaeda paradoxa* (Bunge) Bunge

[C Uzbekistan], “Auf lehmgigsalzigen Stellen [on loamy-salty places] zwischen Buchara und Samarkand 18.10. 1841 (fructifera)”.

Lectotype (designated here): Alexandri Lehmann Reliquiae Botanicae 18.10.1841. Между Бухарой и Самаркандом [between Bukhara and Samarkand], *Belowia paradoxa* m. *Al. Bunge* (LE!; isolectotype: LE!).

*Notes.* — As pointed out by Iljin (1936), the type of this name should be housed in Paris and a “cotype” in St Petersburg. We did not find any original element in P, but two specimens of *Belowia paradoxa* in LE, which are both potential candidates for lectotypification. The first sheet contains a large branch (30 cm long) with a terminal infructescence and a printed standard label of A. Lehmann’s collection in Bunge’s herbarium and his handwritten determination “*Belowia paradoxa* m.”. This label also gives the date and the location mentioned in the protologue written by pencil in Russian. The second sheet has the same label but without date and locality. It contains the lower part (30 cm) of a tall plant with a few branches, most likely from the same plant as on the first sheet. Because of additional information on the label we have selected the first sheet as the lectotype; the second sheet should be treated as an isolectotype.

**3. *Bienertia cycloptera*** Bunge in Boissier, *Fl. Orient.* 4: 945. 1879.

“Hab. in Persia orientali frequens (*Bge!*)”.

Lectotype (designated by Akhiani & al. 2003: 172): [Iran], In Persiae orientalis, *A. von Bunge* (G-BOIS, isolectotypes: K, LE, P).

Generitype of *Bienertia* Bunge.

*Notes.* — Besides the specimen in LE with a handwritten label “*Bienertia cycloptera* Bunge. No 36 Persia inter Tun u. Afris, leg. Bunge”, we found five sheets in P with printed labels “Iter Persicum. Al. de Bunge. 1858–1859. Herb. Al. de Bunge” and one from Buhse’s “Iter Pers. 1847–49”. The specimens from Bunge’s herbarium also have the date (18.10. and 31.10. respectively, according to the two calendars used) and the location “Robot Shur × Tun” [Ribat-e-Shur × Firdaus] that correspond to Bunge’s itinerary (Bunge 1860). Five sheets in P have to be considered as isolectotypes. The specimen in LE and the Buhse specimen in P represent syntypes.

**4. *Borszczowia aralocaspica*** Bunge in *Trudy Imp. S.-Peterburgsk. Bot. Sada* 5: 643. 1878 ≡ *Suaeda aralocaspica* (Bunge) Freitag & Schütze

“In deserto aralo-caspico collegit cel. amicus Cl. Borszczow”. Lectotype (designated by Grubov 1963: 100 [as “holotype”]): Desertum Caspium, regio fluv. Emba infer. In locis salsis ad fontes frigidos salsos Djan Bike, 9.9.1857, *J. Borszczow* (LE). Generitype of *Borszczowia* Bunge.

*Notes.* — Grubov (1963: 100) treated this specimen in LE as [holo-]“typus” because he thought that Bunge’s description was based on a single specimen. However,



it should be considered as lectotype because three more authentic sheets exist in P. Two of them carry only the label “Desert. Aral. Herb. Bunge” and probably represent isolectotypes. The third one has the collecting data “Inter rivul. Kara-Djalga et fl. Ssyrdarja pr. Sstary Tschaganak, 27.8.1858, E. Borszczow” and was determined by Bunge as *Schoberia borszczowii*. That sheet should be considered as a syntype.

5. *Schanginia inderiensis* Bunge, Beitr. Fl. Russl.: 460 (284). 1852.

[W Kazakhstan], “Am Inderschen See [lake Inder] 8.9. 1840 (fructif.)”.

Lectotype (designated here): Alexandri Lehmann Reliquiae botanicae [Herb.] Al. Bunge. *Schanginia inderiensis* m. Al. Bunge (LE!).

= *Suaeda altissima* (L.) Pall.

Notes. — Only in LE we found original material of *Schanginia inderiensis*. The single specimen consists of a fruit-bearing branch arising from a stem section and two small envelopes with plant fragments. It carries the printed standard label of A. Lehmann’s collection in Bunge’s herbarium and his handwritten determination. The tag “Isotypus?” attached by V. Grubov (13.1.1964) proves that the specimen was already taken into consideration for typification. As the plant matches in all characters the protologue, we select this sheet as the lectotype of *S. inderiensis*.

The specimen also carries a label with the name *Suaeda linifolia*. It was added by Iljin, who included the species into *S. linifolia* Pall. (Iljin 1936). Indeed, the fragmentary specimen looks rather similar to that species. However, recent SEM studies by the first author have shown that the seeds of this specimen do not have the typical papillose surface of *S. linifolia*. Therefore, according to the inflorescence structure, the type material represents *S. altissima* (L.) Pall.

6. *Schoberia glauca* Bunge, Enum. Pl. China Bor.: 56. 1833 & in Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 2: 130. 1835 ≡ *Suaeda glauca* (Bunge) Bunge

[N China], “Hab. in subsalsis prope Pekinum et prope Kan-tai” [coll. A. Bunge 1831].

Lectotype (designated here): *Schoberia glauca* m., Chin. bor., Bunge (LE! left-hand plant; image in Raenko 2004); syntypes: LE!, P!, US [image of No. 2491509]!

= *Suaeda stauntonii* Moq.

= *Helicilla altissima* Moq.

= *Salsola asparagoides* Miq. ≡ *Suaeda asparagoides* (Miq.) Makino

Notes. — Iljin (1936) and Grubov (1966) indicated that the type is kept in LE. There we detected two sheets. The first shows six complete plants and two handwritten Bunge labels. The first label is cited above under lectotype and the second reads “China, A. Bunge 1831”. Two printed slips read “teste M. Iljin” and “Typus”, the latter also with a confirmation note by Grubov dated 1.1960.

The plants slightly differ in phenology from flowering to early fruiting stage. The second sheet carries two separately labelled complete plants, which differ strikingly in shape and phenological stage. The right-hand plant is unbranched, about 11 cm high, fully grown and in fruit. It is labelled on blue paper by Bunge as “*Schoberia glauca* Bge. teste Bunge, Chin. bor. Bunge”. Below it is labelled “teste M. Iljin”. The left-hand plant is richly branched, about 22 cm tall, was taken in full growth and bears flower buds only. The handwritten Bunge label reads “*Schoberia glauca* m. Ch. b. Bunge”, with later additions “Herb. Fischer” and “planta serotina est *Helicilla altissima* Moq.” the latter remark certainly referring to the much smaller right-hand plant. Furthermore, the label “Isotypus” is attached. Obviously, that plant has been collected much earlier (the protologue mentions May as flowering time), probably at the first location cited in the protologue. According to the phenology of the species as it is known to us, the fruiting specimen was collected in September. This interpretation is supported by the two sheets with original material in P. The first one (one plant, 25 cm tall) agrees with the fruiting specimen in LE except for its larger size, but provides more information on a handwritten label “*Sch. glaucae* verae, a me in China boreali lectis mixta” fixed on the printed label “China borealis – Al. de Bunge, 1835, Herb. Al. de Bunge”. The herbarium data testify that it came to P from Bunge’s herbarium via Cosson. The second sheet, carrying two plants with three labels, corresponds to the young individual on the second LE sheet. Only one label shows Bunge’s writing “*Schob. glauca* mihi, Chin. bor.” According to an additional label, the specimen came to P in 1857 via H. Jussieu. We have designated the first sheet in LE as lectotype because it was already considered as type by Iljin and Grubov. However, we restrict the lectotype to the left-hand plant because the material was collected apparently on different dates and in different locations. At least on the sheet in P and on the second sheet in LE the material was mounted together by intention.

7. *Schoberia obtusifolia* Bunge, Beitr. Fl. Russl.: 467 (290). 1852. [Kazakhstan], “In der Wüste Ustjurt auf Salzboden, Dr. Cederholm, Herbst 1840 (fructif.)”.

Lectotype (Freitag & Lomonosova 2006: 29): [Kazakhstan], E deserto trans-Uralensi, in salinis Ustjurtensibus, Sept. 1840, *Cederholm* (P!); isolectotypes: LE!, P!)

= *Suaeda crassifolia* Pall.

Notes. — Freitag & Lomonosova (2006: 29) provided detailed information concerning their choice.

8. *Schoberia transoxana* Bunge, Beitr. Fl. Russl.: 467 (291). 1852 ≡ *Suaeda transoxana* (Bunge) Boiss.

[Uzbekistan], “Auf bebauten Stellen um Buchara wild wachsend Aug. 1841 (flor.)”.

Lectotype (designated here): *Schoberia transoxana* m. In cultis cir[c]a urbem Bucharam spontanea crescit. Aug. 41. Reliqu. Lehmann ex Herb. Bunge (P! [right plant

only]); isolectotype: LE!).

= *Suaeda microsperma* (C. A. Mey.) Fenzl

*Notes.* — Corresponding to Iljin (1936) we found one original specimen each in P and in LE. The specimen in P bears two plants and a paper bag with some fragments. On the right is the upper part (30 × 20 cm) of a plant with two labels, one cited above as lectotype and the other with the printed headline “Herb. Al. de Bunge”, the locality “Desert Aralens.” in Bunge’s hand, and the determination “*Schoberia transoxana* Bge = *S. pterantha* Bge.” in an unknown hand. This second label is somewhat confusing because the Aral desert (in whatever meaning) is not close to Bukhara. Eventually it was misplaced and also belongs to the small branch to the left and the content of the paper bag, which is a post-1852 collection (“*Borsczow*, 29.8.1858, Desert Aral. Reg. fl. Ssyr-Darja”) and therefore does not belong to the original material. The specimen in LE contains a fragment of a plant and Bunge’s standard label of Lehmann’s collection and Bunge’s handwritten note “*Schoberia transoxana* m.”. Another slip shows pencil drawings with morphological characters corresponding to the protologue. On a third slip Iljin designated this specimen as “*Suaeda transoxana* spec[imen] authenticum”. We consider the right plant on the sheet in P as the lectotype since its locality is indicated in the protologue.

**9.** *Suaeda ampullacea* Bunge in Bull. Acad. Imp. Sci. Saint-Pétersbourg, ser. 3, 25: 360. 1879.

“Hab. in Mongolia occidentali, deserto Gobi, ad austrum urbis Hami, 28.8.1975 (*Piassezki*)”.

Lectotype (designated by Novoselova 2000: 92 [as “holotype”]): Mongolia: inter Thianschan et fines rossicos, urbis Hami, deserto. 28. Aug./9. Sept. 1875, [fr.], *Dr. Piassezky* (LE). = *Suaeda aralocaspica* (Bunge) Freitag & Schütze ≡ *Borszczowia aralocaspica* Bunge

*Note.* — Grubov (1963) provided an extensive discussion on this name and reduced it to a synonym of *Borszczowia aralocaspica*.

**10.** *Suaeda arcuata* Bunge, Beitr. Fl. Russl.: 461 (285). 1852.

[S Kazakhstan], “Am Jan-Darja, 20.7.1841”.

Lectotype (designated here, confirming Freitag 2001: 117 [as “holotype”]): *Suaeda arcuata* m. Am Jan-Darja, 20.7.[18]41. Reliquiae Lehmannianae. Herb. Al. de Bunge (P!; isolectotype: LE!).

*Notes.* — Iljin (1936) indicated P and LE as the places where the type and the “co-type” are housed. We found two original Bunge specimens, one each in P and LE. The specimen in P consists of two large branches collected in late flowering/early fruiting stage. It is more fully documented with the locality indicated in the protologue and came with Cosson’s herbarium to P. As features described on the label in Bunge’s hand are repeated in the protologue, we have selected this specimen as the lecto-

type of *Suaeda arcuata*. The specimen in LE bears one branch most likely from the same plant as in P and should be treated as isolectotype.

**11.** *Suaeda przewalskii* Bunge in Bull. Acad. Imp. Sci. Saint-Pétersbourg, ser. 3, 25: 360. 1879.

“Hab. in Mongolia australis regione Alaschan, ripa limosissima lacus Zagan-nor, vulgaris et gregaria, 21.9.1871 (*Przewalski*), nec non in prov. Kansu Chinae occidentalis, 23.7.1875 (*Piassezki*)”

Lectotype (designated by Novoselova 2000: 92): Mongolia occidentalis, mont. Alaschan, in ripa limosa salsa lacus Zagan-nor, vulgaris et gregaria. 9./21.9.1871, [fr.] No 392, *Przewalski* (LE); syntype: Mongolia, inter Kansu et Thianschan [Китай, Хэси], jugo U-schi-lin, in arena sicca. 23.7./4.8.1875, [fr.] *Dr. Piassezky*.

*Note.* — P holds a specimen from A. Bunge’s herbarium (17 × 7 cm), which should be considered as isolectotype.

## Appendix

*Suaeda physophora* Pall. var. *papillosa* Freitag, var. nov. Holotype: “*Chenopodium physophorum* m. *Suaeda* Pall. (Habet pro *Salsola fruticosa* Linn. Pall.). Ex Sibiria. *Pall.* (LE!, [left-hand plant only; Fig. 3]); isotypes: BM 000040917! (left-hand plant only), LE! (“*Sals. frutescens*. In siccis squallibus deserti australioris, cum *Halimo* et *Statice suffruticosa*. *Pallas*”).

A varietate typica ramulis et foliis juvenilibus papillis densis scabridis differt.

*Remarks.* — When describing *Suaeda physophora*, Pallas did not mention anything about the plant surfaces. Obviously he was not aware that his material differs in that respect. Iljin (1936: 190) reported “young branches glabrous or covered with very short papillae”, and this was more or less repeated in the subsequent floras of Middle Asia except for Prатов (1972: 74), who explicitly stated that the young branches are glabrous. No reports about papillose leaves have been seen. In fact, when I first saw the specimen *Wuchrer 369*, which is all over covered with an extremely dense and stiff indumentum, I thought about a new species, as did the second author when she encountered similar scabrous forms of *S. heterophylla* (Kar. & Kir.) Bunge and described them as *S. scabra* (Lomonosova 2005). However, later it became evident that the indumentum in *S. physophora* varies much in density, extent and longevity. As no other correlated characters could be found and the ecological niche and distribution area are almost identical with the typical glabrous form, varietal rank appears to be adequate for the papillose plants.

*Other specimens seen.* — W KAZAKHSTAN: Tongiz depression, 40 km NE of Kamyshlybash, 46°15'N, 62°30'E, 11.7.1990, *W. Wuchrer 369* (KAS!); Mangyshlak peninsula, Aktau area, upper slopes of the Ustyurt plateau, 44°10'25"N, 53°3'35"E, 14.5.1995, *M. Schnittler 6144* (GFW, KAS!).



## Acknowledgements

We are most thankful to the curators of the herbaria LE (O. V. Cherneva, N. N. Tzvelev, A. E. Borodina-Grabovskaya), P (S. Hue, T. Deroin) and BM. We also thank the reviewers A. Sennikov and A. Sukhorukov for useful comments on the manuscript and the editor for useful technical and linguistic suggestions. Finally we gratefully acknowledge the financial support by the Russian Foundation for Basic Research (RFBR) to the first author under the numbers 08-04-01021, 08-04-00393 and 11-04-00123 and for an earlier travel grant by the German Research Foundation (DFG) to the second author under the number 436 RUS 113/282/0(R).

## References

- Akhani H., Ghobadnejhad M. & Hashemi S. M. H. 2003: Ecology, biogeography and pollen morphology of *Bienertia cycloptera* ex Boiss. (*Chenopodiaceae*), an enigmatic C4 plant without Kranz anatomy. – Pl. Biol. **5**: 167–178.
- Belyaeva I. V. & Sennikov A. N. 2008: Typification of Pallas' names in *Salix*. – Kew Bull. **63**: 277–287.
- Borodina-Grabovskaya A. E. 2007: Tipifikaciya nasvaniy rasteniy, opisannykh A. A. Bunge v rabote “Enumeratio plantarum, quas in China borealis collegit Dr Al. Bunge, anno 1831” [Typificatio nomini plantarum ab auctore A. Bunge in commentationibus “Enumeratio plantarum, quas in China borealis collegit Dr A. Bunge, anno 1831” descriptorum]. – *Novosti Sist. Vyssh. Rast.* **39**: 313–319.
- Bunge A. A. 1833: Enumeratio plantarum, quas in China boreali collegit Dr Al. Bunge. Anno 1831. – Preprint 73 p., without date and place.
- Bunge A. A. 1835: Enumeratio plantarum, quas in China boreali collegit Dr Al. Bunge, anno 1831. – *Mem. Acad. Imp. Sci. St.-Petersbourg Divers Savans.* **2**: 75–147.
- Bunge A. A. 1843: Novum genus *Chenopodearum*. – *Linnaea* **17**: 120.
- Bunge A. A. 1852: Beitrag zur Kenntnis der Flora Russlands und der Steppen Central-Asiens. – *Mem. Acad. Imp. Sci. St.-Petersbourg Divers Savants* **7**: 177–535.
- Bunge A. A. 1860: Die russische Expedition nach Chorasman in den Jahren 1858 und 1859. – *Petermanns Geogr. Mitt.* **6**: 205–226.
- Bunge A. A. 1878: *Salsolacearum* novarum in Turkestanina indigenarum descriptiones. – *Trudy Imp. S.-Peterburgsk. Bot. Sada* **5**: 642–646.
- Bunge A. A. 1879a: *Binertia cycloptera*. – Pp. 945–946 in: Boissier E., *Flora orientalis* **4**. – Genevae & Basiliae: H. Georg.
- Bunge A. A. 1879b: Enumeratio *Salsolacearum* omnium in Mongolia hucusque collectarum. – *Bull. Acad. Imp. Sci. Saint-Petersbourg*, ser. 3, **25**: 349–371.
- Bunge A. A. 1880: Enumeratio *Salsolacearum* centrasiaticarum. – *Trudy Imp. S.-Peterburgsk. Bot. Sada* **6**: 403–459.
- Eichwald K. E. 1831: Plantarum novarum vel minus cognitarum quas in itinere Caspio-Caucasico observavit Dr Eduardus Eichwald **1**. – Vilnae & Lipsiae: L. Voss.
- Freitag H. 2001: *Suaeda*. – Pp. 104–126 in: Ali S. I. & Qaiser M. (ed.), *Flora of Pakistan* **204**. – Karachi & St Louis: Missouri Botanical Garden.
- Freitag H. & Lomonosova M. 2006: Typification and identity of *Suaeda crassifolia*, *S. prostrata* and *S. salsa*, three often confused species of *Suaeda* sect. *Brezia* (*Chenopodiaceae*, *Suaedoideae*). – Willdenowia **36**: 21–36.
- Grubov V. I. 1963: O rode Borszczowia Bge (Chto takoe *Suaeda ampullacea* Bge?) [About the genus *Borszczowia* Bge. (What is *Suaeda ampullacea* Bge?)]. – *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR* **22**: 100–104.
- Grubov V. I. 1966: Rasteniya Central'noi Azii [Plantae Asiae Centralis] **2**. – Moskva & Leningrad: Nauka. [English ed.: 2000, *Plants of Central Asia*, Enfield/Plymouth: Science Publishers].
- Gubanov I. A., Bagdasarova T. V. & Balandina T. P. 1998: Nauchnoe naslediyе vidayushchikhsya russkikh uchenykh G. S. Karelina i I. P. Kirilova [Scientific heritage of the outstanding Russian florists G. S. Karelin and I. P. Kirilov] – Moskva: mimeographed.
- Hörandl E. & Stuessy T. E. 2010: Paraphyletic groups as natural units of biological classification. – Taxon **59**: 1641–1653.
- Ijlin M. M. 1936: *Suaedeae*. – Pp. 174–200 in: Komarov V. L. (ed.), *Flora SSSR* **6**. – Moskva / Leningrad: Akademii Nauk [English editions: 1970 Jerusalem; 1985 Dehra-Dun / Königstein: P. Singh/Koeltz].
- IPNI 2011: The International Plant Names Index. – Published at <http://www.ipni.org/> [accessed September 2011]
- Kapralov M. V., Akhani H., Voznesenskaya E. V., Edwards G., Franceschi V. & Roalson E. H. 2006: Phylogenetic relationships in the *Salicornioideae* / *Suaedoideae* / *Salsoloideae* s.l. (*Chenopodiaceae*) clade and a classification of the phylogenetic position of *Bienertia* and *Alexandra* using multiple sequence datasets. – *Syst. Bot.* **31**: 571–585.
- Ledebour C. F. 1829: Icones plantarum novarum vel imperfecte cognitarum florum rossicam, imprimis altaicum, illustrantis. – Rigae & Londini, etc.: I. Deubner, Treuttel & Wörz, etc.
- Lipschitz S. J. 1947: Russkie botaniki. Biografo-bibliograficheskii slovar' [Botanicorum rossicorum lexicon biographo-bibliographicum] **1**. – Moskva: Societatis Naturae Curiosorum Mosquensi.
- Litvinov D. I. 1909: Bibliografiya flory Sibiri [Bibliography of the flora of Siberia]. – *Trudy Bot. Muz. Imp. Acad. Nauk* **5**.
- Lomonosova M. N. 2005: Novye vidy semeistva *Chenopodiaceae* [New species of the family *Chenopodiaceae*]. – *Bot. Zhurn.* **90**: 1248–1252.

- Lomonosova M., Brandt R. & Freitag H. 2008: *Suaeda corniculata* (*Chenopodiaceae*) and related new taxa from Eurasia. – *Willdenowia* **38**: 81–109.
- McNeill J., Barry F. R., Burdet H. M., Demoulin V., Hawksworth D. L., Marhold K., Nicolson D. H., Prado J., Silva P. C., Skog J. E., Wiersma J. H. & Turland N. J. 2007: International Code of Botanical Nomenclature (Vienna Code). – *Regnum Veg.* **146**.
- Meyer C. A. 1829a: *Schoberia*. – P. 11, t. 44–45 in: Ledebour C. F. (ed.): *Icones plantarum novarum vel imperfecte cognitarum, florum Rossicam, imprimis Altaicam, illustrantes* **1**. – Rigae & Londini, etc.: I. Deubner, Treuttel & Wörz, etc.
- Meyer C. A. 1829b: *Chenopodeae*. – Pp. 370–417 in: Ledebour C. F. (ed.), *Flora altaica* **1**. – Berolini: G. Reimer.
- Meyer C. A. 1831a: Verzeichniss der Pflanzen, welche während der, auf Allerhöchsten Befehl, in den Jahren 1829 and 1830 unternommenen Reise im Caucasus und in den Provinzen am westlichen Ufer des Caspischen Meers gefunden und eingesammelt worden sind. – St. Petersburg: Kaiserlichen Akademie der Wissenschaften.
- Meyer C. A. 1831b: XIII. *Schoberia microsperma* C. A. Meyer. – P. 14 in: Eichwald E., *Plantarum novarum vel minus cognitarum quas in itinere Caspio-Caucasico observavit Dr Eduardus Eichwald* **1**. – Vilnae & Lipsiae: L. Voss.
- Miller H. S. 1970: The herbarium of Aylmer Bourke Lambert. Notes on its acquisition, dispersal and present whereabouts. – *Taxon* **19**: 489–553.
- Moquin-Tandon C. H. B. A. 1840: *Chenopodearum* monographica enumeratio. – Parisiis: P.-J. Loss.
- Novoselova M. S. 2000: *Chenopodiaceae* Vent. – Pp. 83–93 in: Grubov V. I. (ed.), *Katalog tipovykh obrazcov sosudistykh rastenii Central'noi Azii, khraryashchikhsya v Gerbarii Botanicheskogo Instituta imeni V. L. Komarova (LE)* [Catalogue of the type specimens of Central Asian vascular plants in the Herbarium of the Komarov Botanical Institute (LE)]. – St. Petersburg: Izdatel'stvo Peterburgskogo Universiteta.
- Pallas P. S. 1803: *Illustrationes plantarum imperfecte vel nondum cognitarum, cum centuria iconum*. – Lipsiae: G. Martini.
- Pratov U. 1972: *Chenopodiaceae*. – Pp. 29–137 in: Bondarenko O. N. & Nabiev M. M. (ed.), *Opredelitel' rastenii Sredney Azii* [Conspectus florum Asiae Mediae]. – Tashkent: FAN.
- Raenko L. M. 2004: Specimens from collections of A. A. Bunge from China and Mongolia: *Schoberia glauca*. – St. Louis: Published at <http://www.mobot.org/mobot/research/leguide/collections/16/340.html>.
- Schütze P., Freitag H. & Weising K.: An integrated molecular and morphological study on *Suaedoideae* Ulbr. (*Chenopodiaceae*). – *Pl. Syst. Evol.* **239**: 257–286.
- Staffeu F. A. & Cowan R. S. 1981, 1983, 1985: Taxonomic literature, ed. 2, **3**. – *Regnum Veg.* **98**.
- Staffeu F. A. & Mennega E. A. 1995: Taxonomic literature, Suppl. **3**. – *Regnum Veg.* **132**.
- Sytin A. K. 1997: Petr Simon Pallas – botanik [Peter Simon Pallas – a botanist]. – Moskva: KMK Scientific Press.
- Tzvelev N. N. 1993: Zametki o marevykh (*Chenopodiaceae*) vostochnoi Evropy. [Notes on *Chenopodiaceae* of eastern Europe]. – *Ukrainsk. Bot. Zhurn.* **50**: 78–85.