

Brief Report

What Is “*Apocynum sibiricum*”? A Critical Comment on the Long-Term Taxonomic Homonymy

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Abstract: The necessity of the typification of the *Apocynum* L. s.l. (incl. *Poacynum* Baill. and *Trachomitum* Woodson) (Apocynaceae) species is crucial for future dogbane diversity estimations. Still, the original material of many taxa of the genus *Apocynum* s.l. is doubtful or remains to be discovered. This study’s topic is resolving a long-term taxonomic homonymy around the widely used binomial “*A. sibiricum*”. The misusing of the name “*A. sibiricum*” became a reason for long-term misunderstanding of the meaning of the binomial *Poacynum sarmatiense* (Woodson) Mavrodiev, Laktionov & Yu.E.Alexeev (*A. sarmatiense* (Woodson) Wissjul.; *T. sarmatiense* Woodson) and therefore for the misestimation of the *Apocynum* s.l. diversity in Russian and other Eurasian floras. Resolving this issue, here, we designate the lectotype of *A. sibiricum* Jacq. and the name “*A. sibiricum* Pall.” was validated within *Poacynum* as *P. pallasianum* Mavrodiev, Sytin, Laktionov & Vasjukov nom. nov. (*Apocynum sibiricum* auct., non Jacq.) with the lectotype selected from the original collections of Peter Simon Pallas.

Keywords: Apocynaceae; *Apocynum* L.; *Poacynum* Baill.; *Trachomitum* Woodson; Peter Simon Pallas; lectotype; Eurasian flora; flora of North America



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1. Introduction

The broadly defined genus *Apocynum* L. (including *Poacynum* Baill and *Trachomitum* Woodson) (Apocynaceae) is distributed in temperate regions of Europe, Asia, and North America [1–5]. This group is of great economic importance [6–8]. In the 1920s to 1950s, in the Soviet Union, no fewer than ten books and brochures were published, focusing on numerous aspects of the economic use of *Apocynum* species, its biology, cultivation prospects, and methods. The number of dissertations on *Apocynum* defended during the same period in the USSR has yet to be determined, but we are likely talking about dozen of such works. Different subdivisions (incl. special institutions) of the V.L. Lenin Academy of Agricultural Sciences (VASKhNIL) focused solely on *Apocynum*-related issues [6]. This exciting topic warrants separate research, especially considering that Soviet traditions in studying the economic role of *Apocynum* were rooted in observations by various naturalists

of the pre-Soviet period. In short, due to its enormous economic importance, the cultivation of *Apocynum* in the USSR was listed among strategic economic priorities, at least before the Second World War.

The economic significance of *Apocynum* is also emphasized today. As summarized in the current review of this topic, dogbane is an essential medicinal perennial plant with good ecological and economic value. Its leaves have many pharmacological effects, such as anti-inflammatory, anti-depression, anti-anxiolytic, etc., while its fibers are titled the “king of wild fibers” [7,8].

A comprehensive phylogeny of this economically important genus does not exist. Mavrodiev et al. [9] and Livshultz et al. [10] published initial phylogenetic results based on five species from the broadly defined *Apocynum*. Livshultz et al. [10], who focused their study on the whole tribe Apocynae, reported presumed paraphyly of *Apocynum* s.str., which may have led to the acceptance of the genus *Apocynum* in its broad circumscription [10]. In part of *Apocynum*, these authors used mostly cpDNA sequence data [10] (Appendix 1). Both Livshultz et al. [10] and Mavrodiev et al. [9] found that the clade (*Apocynum* s.l. plus *Cleghornia* Wight) (the subtribe Apocyninae) is well supported. Genus *Poacynum*, as circumscribed by Mavrodiev et al. [9], appeared as monophyletic in all analyses conducted by Livshultz et al. [10] and Mavrodiev et al. [9].

Woodson [1] pointed out that all Eurasian species of broadly defined *Apocynum* are, in fact, from two different genera: *Poacynum* and *Trachomitum*. Using ITS and cpDNA sequence data, Mavrodiev et al. [9] demonstrated that the broadly defined *Apocynum* consists of two well-supported sister clades: the North American (*Apocynum* s.str.) and the Eurasian (*Poacynum* plus *Trachomitum*). The latter genus was analytically defined as a non-supported sister group to *Poacynum* [9]. Based on the results of their molecular analysis, Mavrodiev et al. [9] included *Trachomitum* to *Poacynum*. Contrary to Livshultz et al. (2018) [10], Mavrodiev et al. [9] kept Woodson’s [1] proposition regarding the application of the name “*Apocynum* L.” solely to the North American plants. In summary, the latter phylogenetic analysis [9] aligns well with both the morphology and geographic distributions of either narrowly defined *Apocynum* or broadly defined *Poacynum* (incl. *Trachomitum*).

Unfortunately, modern researchers have simply ignored Woodson’s [1] description of *Trachomitum* and his strong, even exhaustive morphological evidence in favor of the generic rank of *Poacynum* [1]. For instance, both *Poacynum* and *Trachomitum* are not mentioned in the “big” taxonomic revisions of the family Apocynaceae Juss. [11,12]. Thus, Endress et al. [12] (p. 184) and Livshultz et al. [10,13] include only two genera within the subtribe Apocyninae, *Cleghornia* and *Apocynum*, without providing any synonyms for the latter.

Contrary to both long-term taxonomic tradition [1–4,9] and the results of the most recent plastome-based phylogeny of Apocynaceae s.l. [14], WFO [15] still currently incorrectly lists *Poacynum* and *Trachomitum* as synonyms for the genus *Gymnema* R. Br. (Apocynaceae).

According to Woodson [1], the description of *Poacynum* is the only notable event in the taxonomic history of *Apocynum* s.l. between 1844 and 1913. His assessment of the first taxonomic revision of the broadly defined *Apocynum*, written by Beguinot and Belosersky [16], is low: ‘All in all, this monograph is more of a curiosity than a scientific work’ [1] (p. 42). Woodson [1] also disregarded one of the general messages from Beguinot and Belosersky’s study [16]: that intuitive taxonomy is the best approach to the diversity of *Apocynum* species. This monograph [16] served as a helpful taxonomic framework, forming the basis for many of Woodson’s (and others’) suggestions and conclusions.

As summarized by Johnson et al. [17] (p. 1376), Woodson [1] reduced over 80 described species of *Apocynum* to seven. The remaining taxa were relegated by him to the ranks of subspecies and varieties, or conceptualized as hybrids. Woodson [1] also accepted *Trachomitum* within the circumscription of two species and *Poacynum* within the circumscription of three. Despite Woodson’s [1] penchant for splitting taxa, his solution for *Apocynum* s.str. strictly aligns with the tradition of taxonomic lumping. The latter logically culminated with the modern study by Lemke [5], who listed two species and one hybrid of *Apocynum* in the North American flora. On the contrary, 13 *Poacynum* (incl. *Trachomitum*) species are listed

in the flora of Eurasia today [1,2,9]. It was also noted that the current taxonomic approach to the genus's diversity is hardly the last [9].

The polymorphism mystery of both *Apocynum* and *Poacynum* can be reasonably approached only by referring to the phenomena of interspecific hybridization and related sympatric speciation [1,17]. The following conclusion from this proposition is the necessity of estimation of taxa that can mutually hybridize, producing enormous variability of forms [1,5,17]. We believe neither future systematic nor biosystematics investigation of *Apocynum* s.l. can effectively help resolve this issue if the pure taxonomic dimension of the problem is ignored. However, the original material of many species of *Apocynum* s.l. is doubtful or remains to be discovered. This study's primary topic is resolving a long-term taxonomic discussion around the widely used name "*Apocynum sibiricum*", which seems impossible without proper work with related original material and correspondent typification procedures.

The relevance of our study has to be apparent from the fact that the misusing of the name "*Apocynum sibiricum*" eventually became a reason for long-term misunderstanding of the meaning of the binomials *P. sarmatiense* (Woodson) Mavrodiev, Laktionov & Yu.E.Alexeev (*A. sarmatiense* (Woodson) Wissjul.; *T. sarmatiense* Woodson), and *A. cannabinum* L., and therefore for the misestimation of the *Apocynum* s.l. diversity in both Eurasian and North American floras. Due to the economic importance of the genus, such misestimation may lead to significant bias in agricultural and medical studies of the dogbanes. The unresolved taxonomy of both *Apocynum* and *Poacynum* can also bias modern high-tech molecular works. For example, it is also yet to be resolved which species of *Apocynum* s.l. have had their genomes recently sequenced [18,19]. The same issue applies to the actual object of recent chromosome-scale genome analyses, especially considering their possible phylogenetic and economic implications [20].

2. Results and Discussion

2.1. *Apocynum sibiricum* Jacq.

The search for the original material of N. K. Jacquin's species is an issue [21], and the typification of *A. sibiricum* is not an exclusion from this rule. Jacquin wrote in the first line of the prologue of *A. sibiricum* Jacq.: "Jam ab aliquot annis proposito titulo semina hujus plantae a pluribus Botanicis accepi (For several years now, I have received the seeds of this plant from various botanists). . ." [22] (p. 37). However, today, it is impossible to estimate the names of his correspondents. Erik Laxmann is one of Jacquin's trustworthy suppliers of herbarium who passed him plant collections from Siberia [22] (p. 422). However, no evidence exists that Laxmann provided Jacquin seeds or herbarium of any Siberian plants of *Apocynum*. There are also no reliable sources of evidence that Jacquin received any collections of *Apocynum* from Pallas, even if such a possibility seems logical.

As summarized by D'Arcy [21], "Vienna, the Linnaean Herbarium, and the British Museum are probably the prime places to look for Jacquin types" [21] (p. 559). Examining these herbaria, we found no authentic specimens of *A. sibiricum*. The origin of the single specimen of *A. sibiricum* from LINN (309.1) can only be traced to the Upsala Botanical Garden (HU). Edward J. Smith annotated this collection as [*A. sibiricum* Murr. and simultaneously as [*A. hypericifolium* Mss. B [23].

The semantics of the discussed taxon name could be more precise. The critical issue is the contradiction between the image of this plant [22] (p. 66) and its specific epithet. Jacquin provided a high-quality drawing of a plant with clearly sessile and semi-sessile leaves (Figure 1). However, all known Eurasian species of *Apocynum* possess no sessile leaves [1,2]. Consequently, Jacquin's image undoubtedly corresponds to the North American plant, contradicting the specific epithet of the latter. Considering this issue, Woodson [1] summarized that *A. sibiricum* Jacq. is, in fact, identical to North American *A. hypericifolium* Aiton. However, the semantic identity of both names was evident long before Woodson [1]: William Aiton himself listed Jacquin's *A. sibiricum* as a "synonym" of his species [24]. Commenting on this situation, Woodson [1] (p. 139) pointed out, that "... botanists were quick to take up *A. hypericifolium* ..., while *A. sibiricum* ..., perhaps

because of the misleading geographical adjective, was disregarded for over a hundred years after its publication. In such a case, the practical course is to follow the so-called “Fifty-year rule” tacitly established in the International Code of Nomenclature and adopt the better-known designation”. Using modern taxonomic language, one may be able to tell that Woodson [1] offered to conserve the name of *A. hypericifolium* Aiton against the binomial *A. sibiricum* Jacq. (Arts. 14.1 and 14.2 of the International Code of Nomenclature for algae, fungi, and plants (hereafter ICN, ref. [25])). Later, however, Woodson corrected this way of thought and, in his treatment of Apocynaceae in Flora of North America, he included *A. hypericifolium* in the list of synonyms for *A. sibiricum* [26]. Thus, the “Siberian” plant became a part of North American flora and is nowadays even included in the list of synonyms of *A. cannabinum* [5]. Because of this, the other Jacquin’s phrase in the protologue of *A. sibiricum* is worth stressing: “Apocyno cannabinoid proximate”. In other words, Jacquin himself mentioned his species’ relation with North American dogbane (not with European *A. venetum* L., for example), still keeping the specific epithet “*sibiricum*”.



Figure 1. Lectotype of *A. sibiricum* Jacq. [22] (table 66). Credit: Biodiversity Heritage Library, reproduced with permission.

Jacquin's table 1 from his *Miscellanea Austriaca* [27] contains only a detailed drawing of flowers of *A. sibiricum* (l.c., fig. 1). Therefore, the image in table 66 from *Hortus botanicus vindobonensis* (Figure 1) [22] is the only known original drawing that was available to Jacquin at the time of the publication of the binomial '*A. sibiricum* Jacq.' To reiterate, no authentic specimens of the latter name are accessible today. Consequently, we can consider table 66 as an original material of '*A. sibiricum* Jacq.' (Arts. 9.3 and 9.4 of the ICN [25]) and take this image as its lectotype.

Such selection leads to taxonomic conclusions. Figure 2 provides a graphical representation of the intuitive images [28] of the leaf shapes of *A. cannabinum* (a) and *A. sibiricum* (b), as available in the authentic collections (Figures 1 and 3). From this, *A. sibiricum*, as established by Jacquin [22], clearly differs from typical *A. cannabinum* due to its smaller, mostly sessile leaves. Therefore, from a morphological standpoint, *A. sibiricum* cannot be circumscribed with *A. cannabinum* [5], and it must be accepted at the specific rank and status [1,26].

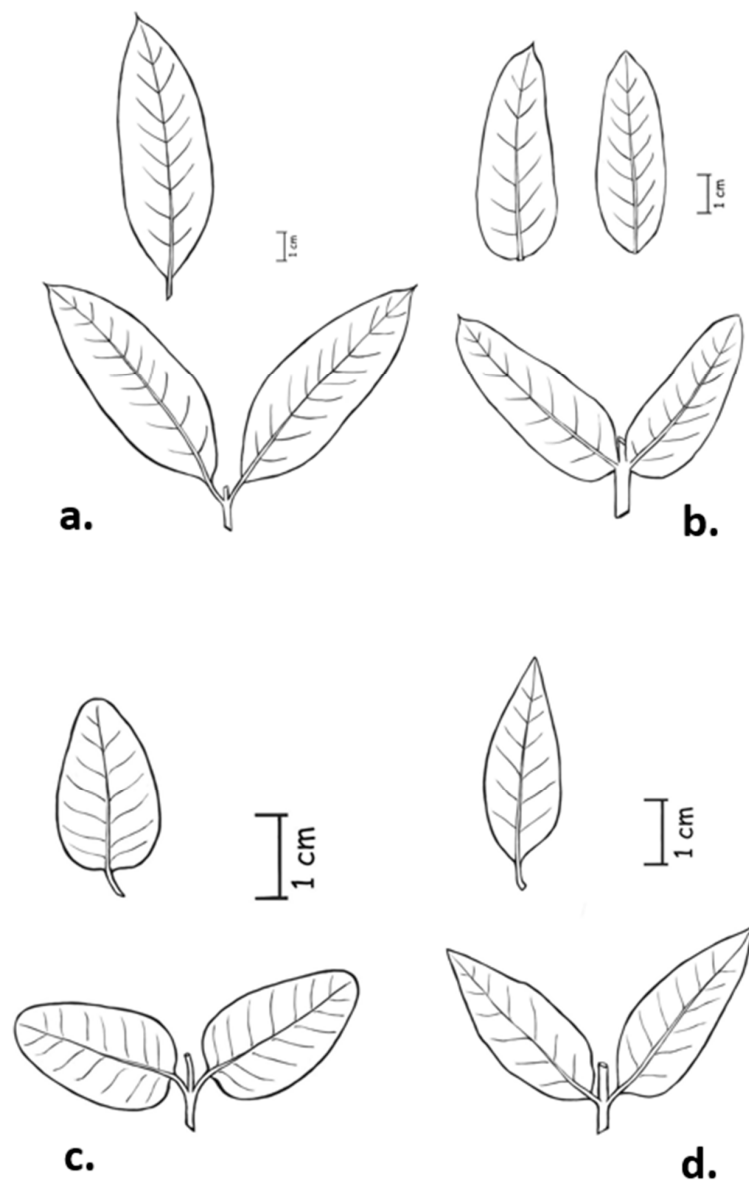


Figure 2. A graphical representation of the intuitive images of the leaf shapes of *A. cannabinum* (a), *A. sibiricum* (b), *P. sarmatiense* (c), and *P. pallasianum* nom. nov. (d), as available in the authentic collections. Credit: Panfilova KI.



Figure 3. Lectotype of *A. cannabinum* L. from Linnaeus Herbarium (LINN 309.4). Selected by Reveal in Jarvis [29] (p. 307). Credit: herbarium LINN, reproduced with permission.

2.2. *Apocynum sibiricum* Pall., nom. nud.

Pallas's interest in *Apocynum* was partly economically motivated. For example, in 1793, while traveling through Western Ciscaucasia, Carolina Ivanovna Pallas, the wife of the great naturalist, became interested in the fibrous volatiles of the dogbanes fruit. She found these volatiles could be useful in making cotton wool or yarn. She even made gloves from this fiber, which she showed at a meeting of the Free Economic Society in St. Petersburg (Russian Empire) [30].

However, Pallas never published any name within *Apocynum*. The binomial "*Apocynum sibiricum* Pall.", widely used by past authors, in fact, is a "nomen nudum" and not part of any of Pallas' publications [30]. Robert Brown was the first author to publish this name in the preprint "Asclepiadeae" in 1810 [31,32] under his authorship but with explicit reference to the Pallas collection (see below).

However, Brown's binomial "*Apocynum sibiricum* R.Br." (Asclepiadeae: 57. 1810) [31] is a later homonym of the name "*Apocynum sibiricum* Jacq. (see Art. 53.1 of ICN [25]), and it was never conserved, protected, or sanctioned. Therefore, it is illegitimate. The same is true regarding the names *A. sibiricum* Pall. ex Roem. & Schult. (Syst. Veg. 4: 405. 1819) [33], *A. sibiricum* Pall. ex Ledeb. (Fl. Altaic. 1: 235. 1829) [34], and *A. sibiricum* Pall. ex Russanov (Trudy Inst. Nov. Lubyen. Syr. 7: 43. 1933) [6]. Thus, multiple attempts to validate the binomial "*A. sibiricum* Pall." could have been more successful. Also, neither Ledebour [34], Russanov [6], or Roemer and Schultes [33] (the latter authors essentially repeated Brown's [31] text) cited any additional collections of Pallas besides what was cited in Brown's preprint [31].

The first brief available Latin description of *A. sibiricum*'s habitat is as follows: "1. In salsis desertorum Astrachanensium P.S. Pallas, M.D. [in Herb. Banks (ubi v.s.)]" [31] (p. 57). We found that the latter remark is an exact citation of the herbarium label of the specimen from the London Museum of Natural History (BM 001014051), written by Robert Brown's hand (Figure 4). But even if we know that Sir Joseph Banks bought Jacquin's herbarium material [21], there is no evidence that the specimen BM 001014051 is related to any of Jacquin's original collections. Conversely, it is also well known that Pallas frequently exchanged his herbarium material with Banks himself [30]. Pallas also sent the herbarium to England with E.D. Clarke [30], thereby delegating its further processing and description of new species. Robert Brown also bought a substantial part of Pallas's herbarium (2000–2250 species) and a large cabinet, especially for the British Museum [30] (p. 260), and, therefore, could share a part of this material with Banks, his co-worker [32]. Consequently, it is reasonably likely that the material Brown used to describe *A. sibiricum* came from Pallas himself. The lack of the latter's handwriting on specimen BM 001014051 is explainable. It is well known that others frequently rewrote Pallas's labels without leaving the original, such as, for example, in the case of Fischer's Herbarium in the St. Petersburg Imperial Botanical Garden (now LE) (Sytn, personal observation), so the lack of the original Pallas's label cannot be evidence against the origin of the sample right from the authentic collections of Pallas. Therefore, today, the specimen BM 001014051 is the only known original material of *A. sibiricum* Pall. and can be selected as an eventual type of the latter name if validated (Arts. 9.3 and 9.4 of the ICN [25]).

The specimen BM 001014051 was mounted on the same sheet with another *Apocynum* specimen (BM 001014050). The latter is labeled by G.S. Karelin: "1707. *Apocynum sibiricum* Pall. In salsis Singoriae prope Dschiss-ahatsch", as well as by R. Brown: "2. Sibiria Soongarica—Karelin & Kiriloff, No 1707". From the first label, it is clear that G. S. Karelin and I. P. Kirilov collected this plant at the eastern end (tip) of Lake Balkhash (modern Eastern Kazakhstan). The specimen was cited by the same authors in their *Enumeratio Plantarum in Desertis Songoriae Orientalis* [35,36] with reference to Ledebour's *Flora Altaica* [34]. This specimen (BM 001014050) has a different morphology and geographical origin and requires future taxonomic assessment.

Referring to the description of Roemer and Schultes [33], Woodson [1] listed *A. sibiricum* as the synonym of South European *T. venetum* (L.) Woodson (*A. venetum* L.) (see also specimen from Missouri Botanical Garden (MO 2016258, Herbarium of J. J. Bernhardt), assigned as "*A. sibiricum*" by unknown botanist and later determined by Woodson as "*T. venetum* (L.) Woodson). However, other authors [2] preferred to treat *A. sibiricum* as a synonym of *T. sarmatiense* Woodson (Figure 5). Perhaps the primary source of this thinking is the coexistence of both taxa in Southeast European Russia [1,31]. The latter taxonomic solution seems widely accepted today; for example, the specimen BM 001014051 was databased in a virtual BM herbarium under the binomial "*T. sarmatiense*". However, the simple comparison of the holotype of the latter name (Figure 5) with the authentic collection of Pallas (BM 001014051) (Figure 4) is sufficient to place such synonymizing under a big question mark. Despite similar geography, the leaves of both plants are different: plant BM 001014051 lacks obtuse or rounded leaf apices, as well as truncate or sub-truncate bases of the laminae, the crucial morphological characters of *T. sarmatiense* [1] (p. 162). Again, Figure 2 gives a graphical representation of the intuitive images [28] of the leaf shapes of both species, as available in the authentic collections (Figures 4 and 5). Therefore, the typical *T. sarmatiense* (Figure 2c) is morphologically different from *A. sibiricum* (Figure 2d), as collected by Pallas. The exact distribution of this presumed endemic in Eastern European Russia and perhaps neighboring areas [6] (p. 43) has yet to be determined.



Figure 4. Lectotype of *P. pallasianum* Mavrodiev, Sytin, Laktionov & Vasjukov nom. nov., on the right side of the herbarium sheet (plant # 1), from Joseph Banks' Herbarium (BM 001014051). Credit: herbarium BM, reproduced with permission.



Figure 5. Holotype of *T. sarmatiense* Woodson [1] (GH 00093153). Credit: herbarium GH, reproduced with permission.

Despite Woodson's proposition that plants of *Poacynum* s.str. occupy a relatively small district in central Asia [1], Mavrodiev et al. [9] included *Trachomitum* within *Poacynum* based on the results of their molecular phylogenetic study. Still, they adhered to Wood-

son's [1] suggestion that the name "*Apocynum*" should be exclusively applied to North American plants (see above). The latter are morphologically distinct from the Eurasian dogbanes. Notably, the inflorescence of *Apocynum* s.str. forms a trichasium, whereas that of *Poacynum* and *Trachomitum* is a monochasium [1]. Additionally, corollar appendages of *Apocynum* s.str. remain distinct and separate, while they coalesce into a ring in *Poacynum* and *Trachomitum* [1].

Thus, plants of Pallasian *A. sibiricum* belong to the genus *Poacynum*. Therefore, here, we decided to validate the name *A. sibiricum* Pall. within *Poacynum* and typify it by the specimen BM 001014051. We named a new species in honor of Peter Simon Pallas (1741–1811), a great German naturalist and traveler, and professor of the St. Petersburg Academy of Sciences (Russian Empire) [30].

3. Conclusions

1. A comparison of the lectotypes of North American *Apocynum cannabinum* and *A. sibiricum* (*A. hypericifolium*) convinces us that both entities are morphologically different from each other. Therefore, *A. sibiricum* should be accepted at the specific rank, as suggested by earlier authors.

2. A comparison of the lectotype of Eurasian *Poacynum pallasianum* and the holotype of *P. sarmatiense* convinces us that the latter is morphologically different from the former. Therefore, *P. pallasianum* should be accepted at the specific rank.

3. Respectively, we propose the following nomenclatural and taxonomic arrangement for both here-resurrected taxa:

Apocynum sibiricum Jacq., Hort. Bot. Vindob. 3: 37. 1777 (*A. hypericifolium* Aiton, Hort. Kew. 1: 304. 1789).

Lectotype (designated here): Icon–Jacquin, 1777: table 66 (Figure 1).

Poacynum pallasianum Mavrodiev, Sytin, Laktionov & Vasjukov **nom. nov.** (*A. sibiricum* R.Br., Asclepiadeae: 57. 1810, nom. illeg., non Jacq. (1777), repl. syn.; *A. sibiricum* auct. non Jacq.).

Lectotype (designated here) or perhaps holotype: "In salsis desertorum Astrachanensium P.S. Pallas". Herb. Banks (BM 001014051) (Figure 4).

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