



<https://doi.org/10.15407/ukrbotj77.06.413>

Nomenclatural and taxonomic comments on some taxa of *Chenopodiaceae* of the Himalayas and Tibet/Xizang

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Mosyakin S.L., Mandák B. 2020. **Nomenclatural and taxonomic comments on some taxa of *Chenopodiaceae* of the Himalayas and Tibet/Xizang.** *Ukrainian Botanical Journal*, 77(6): 413–427.

Abstract. Nomenclatural corrections and comments are provided on several taxa of *Chenopodiaceae* occurring in the Himalayas and Xizang/Tibet and adjacent areas, following the recent monographic revision of the family in that region and earlier publications. In particular, the original identity of the name *Atriplex bengalensis* (*Chenopodium bengalense*) is discussed and it is confirmed, based on additional evidence, that the name was originally (before its epitypification in 2014) applicable to a robust diploid of the *Chenopodium ficifolium* aggregate, not to the robust hexaploid currently known as *C. giganteum*. It is thus also concluded that the recent proposal by Mosyakin and Mandák (2018) to conserve the name *C. giganteum* with a conserved type corresponding to the current understanding and application of that name will best serve nomenclatural stability. A nomenclatural solution alternative to the proposal to reject the name *A. bengalensis* might be the following: (1) to conserve the name *Atriplex bengalensis* with a conserved type (in fact, to reject the current epitype that taxonomically differs from the lectotype) and (2) to conserve simultaneously the name *C. ficifolium* against *C. bengalense*. The nomenclaturally paradoxical situation with the names *Chenopodium pallidum*, *C. harae*, and *Atriplex pallida* (all now considered homotypic, as justified by Mosyakin and McNeill in 2018), which emerged from the conflicting lectotypification and epitypification of the name *C. pallidum*, is revisited and reconsidered. Possible options for dealing with that nomenclatural problem are outlined: (1) keeping the *status quo*, (2) proposing to conserve the name *C. pallidum* with a conserved type other than the standing lectotype, and (3) proposing to reject the name *C. pallidum*. The last option is considered preferable. Additional considerations are presented on a possible taxonomic identity of *Chenopodium strictum* as originally described by Roth; it is confirmed that that name was misapplied to a widespread Eurasian tetraploid species now properly known as *C. betaceum*. The identity of the name *Bassia fiedleri* is discussed; being a replacement name for *Echinopsilon divaricatum*, it is homotypic with *Bassia divaricata* (Kar. & Kir.) Kuntze (*nom. illeg.*, non F. Muell.) and is a taxonomic synonym of *Grubovia dasiphylla* (as correctly stated by Kadereit and Freitag in 2011), but not a synonym of *Bassia scoparia*. Several comments on type designations of selected taxa of *Chenopodiaceae* from the Sino-Himalayan region are provided as well; e.g., for *Acroglochin persicarioides* and associated names, *Chenopodium karoii*, and *Salsola monopectera*.

Keywords: *Atriplex*, *Bassia*, *Chenopodium*, *Chenopodiaceae*, *Salsola*, China, India, Nepal, nomenclature, taxonomy, typification

Submitted 24 September 2020. Published 24 December 2020

Мосякін С.Л.¹, Мандак Б.^{2,3} 2020. Номенклатурні і таксономічні коментарі щодо деяких представників *Chenopodiaceae* флори Гімалаїв та Тибету (Сіцзану). *Український ботанічний журнал*, 77(6): 413–427.

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Реферат. Наведено номенклатурні коментарі та уточнення щодо декількох таксонів родини *Chenopodiaceae*, які представлені у флорі Гімалаїв і Тибету (Сіцзану) та деяких прилеглих територій і які були нещодавно розглянуті у монографічному опрацьованні родини у цьому регіоні, а також у деяких інших публікаціях. Зокрема, розглянуто ймовірне оригінальне застосування назви *Atriplex bengalensis* (*Chenopodium bengalense*). На основі додаткових даних підтверджено, що ця назва (з моменту її публікації і аж до її епітипіфікації у 2014 р.) стосувалася велетенського диплоїда з групи *Chenopodium ficifolium*, але не гігантського гексаплоїда, здебільшого відомого дотепер як *C. giganteum*. Тому прийняття нещодавньої номенклатурної пропозиції (Mosyakin, Mandák, 2018) щодо консервації назви *C. giganteum* із законсервованим типом, який відповідає сучасному розумінню та застосуванню цієї назви, було б найкращим для збереження номенклатурної стабільності. Можливе й номенклатурне рішення, альтернативне до пропозиції відхилити назву *A. bengalensis*, а саме: (1) законсервувати назву *A. bengalensis* із законсервованим типом (по суті, відхилити нинішній епітип, який таксономічно відрізняється від лектотипу) і (2) одночасно законсервувати назву *C. ficifolium* проти *C. bengalense*. Переглянута і обговорена номенклатурно парадоксальна ситуація з назвами *Chenopodium pallidum*, *C. harae* та *Atriplex pallida* (які усі зараз мають розглядатися як гомотипні, як це обґрунтовано у статті Mosyakin, McNeill, 2018), що виникла внаслідок суперечливих лектотипіфікацій та епітипіфікацій назви *C. pallidum*. Окреслені можливі варіанти вирішення цієї номенклатурної проблеми, а саме: (1) підтримання *status quo*, або (2) пропозиція законсервувати назву *C. pallidum* із законсервованим типом іншим, ніж нинішній лектотип, або (3) пропозиція відхилити назву *C. pallidum*. Останній варіант визнано найкращим. Представлені додаткові міркування щодо ймовірної таксономічної приналежності *Chenopodium strictum* в оригінальному розумінні автора виду; підтверджено, що ця назва невірно застосовувалася до розповсюдженого євразійського тетраплоїдного виду, який зараз відомий як *C. betaceum*. Обговорена таксономічна приналежність назви *Bassia fiedleri*; оскільки це замінювальна назва для *Echinopsilon divaricatum*, вона є гомотипною з *Bassia divaricata* (Kar. & Kir.) Kuntze (*nom. illeg.*, non F.Muell.) і таксономічним (гетеротипним) синонімом назви *Grubovia dasiphylla* (як це і було вірно вказано раніше), але не є синонімом назви *Bassia scoparia*. Також представлено декілька коментарів і уточнень щодо типіфікації декількох назв таксонів *Chenopodiaceae* з Китайсько-Гімалайського регіону; наприклад *Acroglochin persicarioides* та таксономічно пов'язаних назв, а також *Chenopodium karoii*, *Salsola monopectera*.

Ключові слова: *Atriplex*, *Bassia*, *Chenopodium*, *Chenopodiaceae*, *Salsola*, Індія, Китай, Непал, номенклатура, систематика, типіфікація

Introduction

The recently published monograph of *Chenopodiaceae* in the Himalayas (Bhutan, Nepal, and northern India: Himachal Pradesh, Jammu and Kashmir, Sikkim, and Uttarakhand) and Tibet (Xizang, China) (Sukhorukov et al., 2019) is an important contribution to world knowledge of the family, both in that region and in other geographic areas. Nevertheless, now that this publication is available, we consider it necessary to provide here several comments and corrections as an amendment for that treatment, mainly concerning the nomenclature and type designations for several taxa of *Chenopodiaceae*, as treated in Sukhorukov et al. (2019) and in some earlier publications. Acronyms of herbaria are given below following *Index Herbariorum* (Thiers, 2008–onward).

Further comments on the identity of Lamarck's specimens of *Atriplex bengalensis* ≡ *Chenopodium bengalense*

Sukhorukov (in Sukhorukov, Kushunina, 2014) proposed to apply the name *Chenopodium bengalense* (Lam.) Spielm. ex Steud. (≡ *Atriplex bengalensis* Lam.) to the hexaploid species commonly known before as *C. giganteum* D. Don (see further details in: Mosyakin, Mandák, 2018b). In our formal nomenclatural proposal (Mosyakin, Mandák, 2018a) to reject the name *Atriplex bengalensis* we have already commented that the two original specimens (syntypes) of *A. bengalensis* in the Lamarck Herbarium [P, barcodes P00381128 (Fig. 1A) and P00381127 (Fig. 1B), the specimen P00381128 was designated as the lectotype: Sukhorukov, Kushunina, 2014: 18] almost certainly represent a diploid taxon related

to *C. ficifolium* Sm. s. str. or belonging to the *C. ficifolium* aggregate. The nomenclatural confusion that resulted from the conflicting simultaneous lectotypification and epitypification of the name *A. bengalensis* was also briefly discussed in our proposals (see also a similar case of *Chenopodium pallidum* Moq. and associated names: Mosyakin, McNeill, 2018, and further details below). In Sukhorukov et al. (2019) the name *C. bengalense* is still applied, without any expression of doubt, to the taxon commonly accepted before under the name *C. giganteum*. As we mentioned, plants of Indian origin morphologically similar to the lectotype and isotype of *A. bengalensis* were cultivated by Bohumil Mandák and his research team in the Experimental Garden of the Botanical Institute CAS in Průhonice near Prague (Mosyakin, Mandák, 2018a), and those plants were uniformly diploid ($2n = 2x = 18$) with the genome size (2C DNA content 1.8 pg) similar to that of *C. ficifolium* s. str. (see Mandák et al., 2016).

An additional historical specimen of *Chenopodium bengalense* (\equiv *Atriplex bengalensis*) that definitely originated from plants cultivated in the Paris Botanical Garden (from where the two original specimens from the Lamarck Herbarium also originated) is available at the James Edward Smith Herbarium at LINN (LINN-HS 1584.23, image available from <http://linnean-online.org/49133/> and <https://plants.jstor.org/stable/10.5555/al.ap.specimen.linn-hs1584-23>). It is annotated as "*Atriplex benghalensis* [sic!] L. [here "L." probably means Lamarck, not Linnaeus]", with an abbreviation on the label "h. R. P." that almost certainly indicates the Royal Botanical Garden of Paris ("Hortus Regius Parisiensis"). As we can judge from digital images, the LINN-HS specimen is conspecific with the two original specimens from the Lamarck Herbarium.

A careful review of earlier literature on Indian taxa of *Chenopodium* provided further compelling evidence supporting our conclusion on the true taxonomic identity of the two original specimens of *A. bengalense* from the Lamarck Herbarium at P.

Indian authors working in the field of genetics and cytogenetics of *Chenopodium* quite often recognized several "cytotypes" within groups of Indian plants identified as *C. album* sensu lato (see, e.g. Mehra, Malik, 1963; Partap, Kapoor, 1985a, b, 1987; Mukherjee, 1986; Bera, Mukherjee, 1987; Kumar, Subramaniam, 1987; Partap, Upadbya, 1987; Bera, 1991; Bera et al., 1993; Gangopadhyay et al., 2002; Bhargava et al., 2005, 2006, 2007; Emmerling-Skala, 2005; Rana et al., 2010; etc.). In fact, *C. album* s. str. is represented only by hexaploids

($2n = 6x = 64$), while diploids and tetraploids belong, in the strict sense, to other species; see Mandák et al. (2018) for a general scheme of polyploid evolution in *Chenopodium* s. str. Thus, the name *C. album* was (and still is) in fact misapplied to plants with $2n = 2x = 18$ (diploids) and $2n = 4x = 36$ (tetraploids).

It seems that the *C. ficifolium* group is morphologically very diverse in India and adjacent regions of southern Asia (see Aellen, 1961; Pandeya et al., 1998; Pandeya, Pandeya, 2003; Mosyakin, 2016, and references therein), but morphological, geographical and evolutionary patterns of that diversity still remain poorly understood. Judging from the cited publications, most of Indian diploids (or even almost all of them?) of *Chenopodium* s. str. either belong to *C. ficifolium* s.l. or are at least closely related to it. In most cases, however, it is difficult to figure out which morphotypes are considered in the cited Indian publications.

Fortunately, Mukherjee (1986) provided brief morphological descriptions of plants and rather diagnostic photographs of leaves of his "*C. album* diploid" and "*C. album* polyploid". His Fig. 1 (upper part of the plant) and Fig. 2a (cauline leaf) labeled as "*C. album* diploid" (Mukherjee, 1986: 755; here reproduced as Fig. 2) evidently represent the morphotype morphologically most closely matching the original specimens (lectotype and syntype) of *A. bengalensis* from the Lamarck Herbarium (Fig. 1A and 1B); that morphotype, in our opinion, is closely related to *C. ficifolium* s. str., or, alternatively (depending on a species concept applied), can be even placed in *C. ficifolium* sensu lato as one of its infraspecific entities.

Moreover, Indian authors (e.g., Gangopadhyay et al., 2002; Rana et al., 2010) recognize at least two morphotypes within "diploid *C. album*", i.e. narrow-leaved and broad-leaved ones. Both these morphologically closely approach *C. ficifolium* s. str., but clearly represent different species, or at least subspecies, in cultivation (B. Mandák, personal observation). They markedly resemble what Sukhorukov and Kushunina (2014) and Sukhorukov et al. (2019) accepted as *C. bengalense*, i.e. tall robust annuals having more or less trilobate leaf blades with a markedly elongated terminal lobe and shorter lateral lobes located closer to the leaf base. In addition, seeds with small crater-like micro-depressions in these *C. bengalense*-like plants assign this species rather to the diploid *C. ficifolium* s.l. than to any hexaploid species.

Some Indian plants evidently related to *C. ficifolium* are exceptionally robust or even gigantic; for example,



Fig. 1. The lectotype (P00381128, A) and syntype (P00381127, B) of *Atriplex bengalensis* Lam. = *Chenopodium bengalense* (Lam.) Spielm. ex Steud. (images from the Lamarck Herbarium, <http://www.lamarck.cnrs.fr>; accessed September 2018)

the plants initially provisionally labeled as belonging to the "CS population" (Singhal, 1994; see Fig. 3) that were later described as *C. santoshii* Pandeya, G.Singhal & A.K.Bhatn. (Pandeya et al., 1998: 484; originally published as "*santoshei*", correctable under Art. 60.8, Note 4 of the ICN: Turland et al., 2018). According to Singhal (1994) and Pandeya et al. (1998), *C. santoshii* can grow up to 3.5 m tall. Probably those plants or other similar local robust diploids of India were progenitors of robust allohexaploid plants usually referred to as *C. giganteum*.

In addition to various cultivated hexaploids commonly identified as *C. giganteum* or *C. album* a.l., robust forms of the *C. ficifolium* species aggregate are also definitely cultivated in India as leaf vegetables locally and collectively known as *bathua* (Singh, 2015a, b; Singh

et al., 2018). For example, the new leaf vegetable cultivar of "*C. album*" Kashi Bathua-2 recently developed at the ICAR – Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh (Singh et al., 2018; additional plant images are available from <https://www.researchgate.net/publication/332780339>), in fact also belongs to the *C. ficifolium* group and by its morphological characters closely approaches the plants that Lamarck described as *Atriplex bengalensis*. The same is true for another recently established cultivar, Kashi Bathua-4; its digital images (habitus, leaves, fruits/seeds) kindly provided to the first author by Dr. B.K. Singh (ICAR – Indian Institute of Vegetable Research) leave no doubt that it is also related to *C. ficifolium* and at least very similar to (if not conspecific with) *C. bengalense* (as defined by its lectotype, not by its standing epitype).



Fig. 2. "*Chenopodium album* diploid cytotype" sensu Mukherjee (1986: 755, Fig. 1, Fig. 2a); compare to Fig. 1.

A special taxonomic study of the underutilized crops (see Partap, Kapoor, 1987; Arora, 2014, etc.) and wild and weedy representatives of the *Chenopodium album* aggregate in the Indian subcontinent and other parts of southern and southeastern Asia is needed.

Thus, we think that, judging from morphological evidence, it is almost certain that Lamarck described under his name *A. bengalensis* the **diploid** plants belonging to the *C. ficifolium* aggregate (or to *C. ficifolium* s.l.); these plants were cultivated in Paris from seeds obtained from India. That conclusion provides further support to our proposals to reject the name *A. bengalensis* and to conserve the name *C. giganteum* with a conserved type to ensure the current application of the widely accepted names *C. ficifolium* and *C. giganteum*.

However, there might be an alternative nomenclatural solution. Now, when we have virtually no doubt that *C. bengalense* (according to its lectotype) represents a robust Indian taxon of the *C. ficifolium* group, it would be a pity to reject that name just because of its epitypification (Sukhorukov, Kushunina, 2014) with a morphologically poor specimen (MW0595516) almost certainly representing another species, and the resulting disruption of the nomenclature of *C. giganteum*. However, it would be also reasonable to safeguard the generally accepted and widely used name *C. ficifolium* against the earlier name *C. bengalense*. The latter will be the priority name

at the species rank if these two taxa are considered as subspecies or some other infraspecific entities of one species. Thus, a two-step proposal would satisfy that need: (1) to conserve the name *Atriplex bengalensis* with a conserved type, thus allowing to get rid of the current epitype, and (2) to conserve simultaneously the name *C. ficifolium* against *C. bengalense*. Now we are considering that nomenclatural alternative. However, future amendments of the *Code* may change the nomenclatural situation (see below).

The problem of *Chenopodium pallidum*: additional comments and nomenclatural options

Probably the monograph of Himalayan and Tibetan *Chenopodiaceae* had been finalized before the article by Mosyakin and McNeill (2018) became available and therefore this nomenclatural note is not cited in Sukhorukov et al. (2019). However, the nomenclatural conclusions reached in our article are unchallengeable from the viewpoint of the current *Shenzhen Code* (ICN: Turland et al., 2018), even if they look somewhat paradoxical: *Chenopodium pallidum* Moq., by its epitypification (but not lectotypification!), is the correct name for a Himalayan species of *Chenopodium*, despite the fact that its lectotype in P belongs to *Atriplex* (!), while *Chenopodium harae* Sukhor. (originally published as "*harai*"; the orthographic error correctable under Art. 60.8 of the ICN) and *Atriplex pallida* (Moq.) Sukhor. are thus homotypic synonyms of *C. pallidum*. Despite that, the names *Chenopodium harae* and *Atriplex pallida* are listed as accepted in Sukhorukov et al. (2019), which is probably taxonomically logical but nomenclaturally incorrect.

Interesting enough, Sukhorukov et al. (2019: 44) cited the lectotype of the name *C. pallidum* that was designated in Sukhorukov and Kushunina (2014: 14) but did not cite the epitype that was designated in the same article on the same page. As we noted (Mosyakin, McNeill, 2018) and as follows from the relevant provisions of the ICN (Turland et al., 2018; see also Lendemer, 2020), it is the epitype, not a lectotype, that ultimately defines the application of a name.

In our opinion, there are three main options for dealing with the confusing nomenclatural situation created by conflicting lectotypification and epitypification of the name *Chenopodium pallidum* (Sukhorukov, Kushunina, 2014, 2015).

The first option is just to retain the *status quo*. In that case the names *Chenopodium harae* and *Atriplex pallida* will remain nomenclatural synonyms of *Chenopodium*



Fig. 3. "A mature plant of CS population" (Singhal, 1994, Plate 1.2G; reproduced from <http://hdl.handle.net/10603/205080>), a robust (up to 3.5 m tall) Indian taxon later described as *Chenopodium santoshii* (Pandeya et al., 1998); evidently related to diploid *C. ficifolium* s. str.

pallidum (according to its epitypification). No nomenclatural and taxonomic changes will be needed in that case; however, the genus-level identity conflict of the lectotype (an *Atriplex*) and the epitype (a *Chenopodium*) of the name *C. pallidum* will not be resolved.

On the other hand, if it is considered useful to restore the application of the name *C. pallidum* in accordance with the taxonomic identity of its lectotype (belonging to *Atriplex*), then the simplest way to do that would be to propose the name *C. pallidum* for conservation with a conserved type other than the standing lectotype (preferably another original specimen from the single gathering cited in the protologue). In that case, if that hypothetical conservation proposal is accepted, the current epitype of *Chenopodium pallidum* (belonging to *Chenopodium*) will have no standing because an epitype supports only the type to which it is linked

by the typifying author (Art. 9.20, Note 8 of the ICN: Turland et al., 2018), the name *Atriplex pallida* will be the correct name for the species of *Atriplex* currently known as *A. schugnanica* Iljin (1936a: 123), and the name *C. harae* will become available for the species of *Chenopodium* now properly called *C. pallidum* due to its epitypification. However, in our opinion, the usefulness of such a conservation proposal is doubtful. It will submerge into synonymy the name *Atriplex schugnanica* that was and still is accepted in several publications and databases; e.g., Iljin (1936b: 97), Ikonnikov (1963: 99; 1979: 139), Grubov (1966: 32), Sidorenko (1968: 338), Pratov (1972: 50), Czerepanov (1995a: 181; 1995b: 347), Hedge, Jafri and Omer (in Freitag et al., 2001: 67), Sukhorukov (2006: 384), Zhu (in Zhu, Sanderson, 2017: 166, as *Obione schugnanica* (Iljin) G.L.Chu), POWO (2020–onward: <http://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:164138-1>), etc.

The third option would be to propose the name *Chenopodium pallidum* for rejection. Anyway, that name remained forgotten for a long time and was taxonomically restored (in conflict with the generic identity of its original specimens) only in 2014 (Sukhorukov, Kushunina, 2014). If that rejection proposal is accepted, the name *Atriplex schugnanica* will be preserved for a species of *Atriplex*, the name *Chenopodium harae* will become available for a species of *Chenopodium*, and the generic identity conflict (the *Atriplex* lectotype versus the *Chenopodium* epitype) will be successfully resolved by nomenclatural rejection of the problematic name itself. At present we consider this nomenclatural option as preferable, and the relevant nomenclatural proposal has been prepared (Mosyakin, Mandák, submitted to *Taxon*, expected in 2021).

It should be noted that possible future changes in the *International Code of Nomenclature...* may open other options for cases such as epitypifications of *Chenopodium pallidum* and *Atriplex bengalensis* (\equiv *Chenopodium bengalense*, see above). For example, the recent proposal to amend the *Code* (Mazumdar et al., 2020: 631) advocated the following amended wording of the first sentence of Art. 9.20 (proposed amended text **in bold**): "The author who first designates (Art. 7.10, 7.11, and F.5.4) an epitype must be followed, **but that choice is superseded if it is in serious conflict with the protologue, in which case an element that is not in conflict with the protologue is to be chosen**". If that (or similarly worded) proposal is accepted, rejection or supersession of an erroneously designated epitype will become possible, and it will be much easier than the current procedure involving nomenclatural conservation or rejection.

On a possible taxonomic identity of *Chenopodium strictum* as originally described by Roth: additional considerations

Sukhorukov et al. (2019: 32–33) commented on *Chenopodium strictum* Roth as follows: "Sukhorukov (2014) discovered that the plants growing in North Himalaya and in Europe differ in their morphological characters and *C. betaceum* Andr. may be the correct name for the European plants. Furthermore, *C. strictum* material from Himalaya, from where the species was described, is scarce (Jammu and Kashmir, India). Further investigations are needed to discover which plants belong under this name". We agree that further investigations are needed and for those investigations to be productive and free from misunderstanding, some comments are needed as well.

From the wording cited above a reader may assume (even if that was not an original intention of the authors) that the taxonomic acceptance of the name *C. betaceum* for European tetraploids (they were also known before as *C. striatum* (Krašan) Murr, or under the misapplied name *C. strictum* auct. non Roth) was restored by Sukhorukov (2014). However, that is not the case.

In fact, Modest M. Iljin in his treatment of *Chenopodiaceae* in the fourth volume of the *Flora of the Ukrainian SSR* (Iljin, 1952: 306–308) explicitly restored the usage of the name *C. betaceum* for the species treated in the *Flora of the USSR* (Iljin, Aellen, 1936) as *C. strictum*. In the same volume, Iljin (1952) also taxonomically and nomenclaturally restored another species described by Antoni L. Andrzejowski (1862), *C. acerifolium* Andr., and demonstrated that that name is of priority for the mainly East European or/and Euro-Siberian species earlier known as *C. klinggraeffii* Aellen, which was, in turn, the replacement name for the illegitimate combination *C. hastatum* (C. Klinggr.) Murr, non Phil. (see Uotila, Lomonosova, 2016; Mosyakin, 2017).

But even before Iljin (1952), Vladimir G. Chrshanovski [also transliterated as Khrzhanovskiy, *Хржановський* in Ukrainian, *Хржановский* in Russian; see a biographic note by Rubtsova (2004)] accepted the names *C. acerifolium* and *C. betaceum* in his treatment of *Chenopodiaceae* in the identification manual of vascular plants of Ukraine (Chrshanovski, 1950: 666); however, he provided no explanation for his taxonomic and nomenclatural decisions. Thus, Iljin (1952) was effectively the first author who not only returned from oblivion, but explicitly accepted the names *C. acerifolium* and *C. betaceum*, and also properly justified his

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restoration of these names for the two now generally recognized species occurring in East Europe and beyond. Already in their treatment of *Chenopodium* in the *Flora of the USSR*, Iljin and Aellen (1936: 35) commented that Indian plants are morphologically somewhat different from the European ones, and because of that they coined the combination *C. strictum* subsp. *striatum* (Krašan) Aellen & Iljin. A comment suggesting that *C. betaceum* is probably the correct name for the European species was also made by Mosyakin (1996: 41–42), and later also by Sukhorukov (2014: 229). Further details and quotations (with translations) from Iljin (1952) and other sources were provided in Mosyakin (2017: 145–146; not cited in Sukhorukov et al., 2019).

However, until recently there was an obstacle to proper restoration of the name *C. betaceum*: no original Andrzejowski's specimens of that species were located in the 1990s – mid-2010s in the KW herbarium (where most of specimens of that researcher are deposited, mainly in the Besser historical collection – KW-BESS). It was documented that at least one original specimen of *C. betaceum* was on loan in BRNU (see Dvořák, 1992: 68, footnote) but, if returned to KW, it was probably misplaced and is still not yet located. In 2016 Pertti Uotila (H herbarium) kindly informed Sergei Mosyakin (KW) about the long-forgotten loan of two original specimens of *C. acerifolium* and one original specimen of *C. betaceum*. Upon the return of these specimens from H to KW the real identity of *C. betaceum* has now been confirmed beyond any reasonable doubt (Mosyakin, 2017). That author then designated as lectotype the specimen KW001002779 and explicitly accepted *C. betaceum* for the European and partly Asian tetraploid species to which the name *C. strictum* had been commonly misapplied in the 20th century, following the problematic nomenclatural resurrection of *C. strictum* by Aellen (1929).

The geographic origin of the type of *C. strictum* was indicated very broadly in the protologue (Roth in Schultes, 1820: 264) and in the book by Roth (1821: 180), as "*in India orientali*", meaning in that case not the eastern part of India proper, but "East India" as opposed to the West Indies in the Western Hemisphere (see Mosyakin, 2017: 146). Despite this, Sukhorukov et al. (2019: 33) assumed that *C. strictum* was described "from Himalaya". In fact, Benjamin Heyne, who was the collector of the original specimen(s) of *C. strictum*, never visited the Himalayan region but did most of his collecting in the southern part of India, within the territories of the present-day states of Tamil Nadu, Karnataka, and Andhra Pradesh [Heyne

(1814), Burkill (1953), Stewart (1982); for a summary, see Mosyakin (2017: 146) and references therein].

Heyne (1814: 54, 133) mentioned a species of *Chenopodium* (as "*Chenopodium viride*", most probably meaning a *Chenopodium* with lax inflorescences) twice in his book, of which the only original mention (not translated from an Indian source) was on page 54 in Table V entitled the *List of Vegetables, the Leaves of which are used by the Natives in their Curries or Stews*. This part of his book is included in "Tract II. Statistical fragments of the Mysore", in which Heyne described his observations during the Mysore Survey, for which he was appointed in 1800 as a surgeon and assistant to Colonel Colin Mackenzie, the superintendant of that survey who led it from 1799 until 1810 (Edney, 1997: 175–176). Mysore (now Mysuru, Karnataka) in the early 19th century was the center of the princely state of Mysore in Southern India. Heyne also participated in a general agricultural survey of the Mysore and Malabar territories (Roy, 1986: 26), and his other scientific activities were also confined to Southern India (see Bor, 1954; Stewart, 1982; Desmond, 1992; Watson, Noltie, 2016; etc.).

Consequently, the original material of *C. strictum* was most probably collected somewhere in the southern part of India. Thus, the claim that "the plants growing in North Himalaya and in Europe differ in their morphological characters" (Sukhorukov et al., 2019: 32–33) is probably valuable from a biogeographic viewpoint because it improves our knowledge of the actual range of the Eurasian plants now properly called *C. betaceum*; however, it tells us nothing about possible differences between the type of *C. strictum* (most probably a southern Indian plant) and the European plants to which the latter name was misapplied.

It is usually assumed that the original specimen or specimens of *C. strictum* has/have been destroyed during World War II with many other historical collections in Berlin–Dahlem (B) (see e.g., Merrill, 1943; Sleumer, 1949; Pilger, 1953; Hiepko, 1987) and only one fragment of an original specimen is still extant in the Paul Aellen herbarium at G (for further details and additional relevant references, see Mosyakin, 2017). That fragment in G is the standing lectotype of *C. strictum* designated by Dvořák (1989: 198, 201, Fig. 3).

But is it possible that some other specimen or specimens of the original collection(s) of Heyne still exists/exist?

During the preparation of our nomenclatural proposal to conserve *C. giganteum* (Mosyakin, Mandák, 2018) the first author studied the digital images of *Chenopodium*

specimens now deposited in the Wallich herbarium at K. It is known that this important collection (see Anonymous, 1913; Candolle, Radcliffe-Smith, 1981; Stafleu, Cowan, 1988; Prakash, 2016; etc.) contains numerous specimens collected in India by Heyne; these specimens were transferred to the Wallich collection as part of the so-called "Madras herbarium" (Anonymous, 1913; Watson, 2013a–onward, 2013b–onward). As explained by Watson (2013b–onward), "In 1829 the East India Company permitted Wallich to add several other collections of dried plants, also kept in the India museum, into his distribution scheme, 'principally with a view to the distribution of their duplicates.' On page 61, Wallich details these additional collections (herbaria), and recounts how they will be indicated in his listing". In particular, it was noted that 'Herb. Madras' "is the large herbarium, with many duplicates, formed by Tranquebar Missionaries Johan Godfried (or Gottfried) Klein (1766–1821), Benjamin Heyne (1770–1819) & Johan Peter Röttler (1749–1836). There are also entries under their separate names, e.g. 'Herb. Heyn.', etc.". Heyne not only left some of his specimens in London during his leave in 1813–1816 but also in 1816, before returning to India, gave most of his collection to A.W. Roth (Anonymous, 1913; Bor, 1954, etc.).

It is noteworthy that plant fragments on at least one sheet from the Wallich herbarium closely match the extant type fragment from G, and the two specimens mounted on that sheet are marked one as originated from Heyne (Wallich Catalogue No. 6952.[E], K barcode K001126338, <http://specimens.kew.org/herbarium/K001126338>) and another as part of the "Madras herbarium" (Wallich Catalogue No. 6952.[A], K barcode K001126337, <http://specimens.kew.org/herbarium/K001126337>) (Wallich, 1832: page 233, entry 6952).

It is possible thus that the two morphotypes mounted on the sheet K001126337/K001126338 may represent Heyne's duplicates of the specimens used by Roth that were deposited in B, or at least were associated with these collections, representing the same or closely related species because they originated from the same collector and most probably from the same region/source. In our opinion, the plant fragment mounted in the left-side bottom corner of the sheet and tentatively associated with the Madras Herbarium and Wallich Catalogue No. 6952.[E] is most similar to the type fragment in G, having a very similar lax partial inflorescences and almost lanceolate upper leaves. The specimen associated with Heyne and Wallich Catalogue No. 6952.[A] is probably represented by two branches and a separate leaf

mounted at the right-side of the sheet. That specimen also shows some similarity to the G lectotype of *C. strictum*, especially if lanceolate upper leaves are considered; however, inflorescences in that specimen seem to be more condensed than in the G lectotype. Also, the letter E written in pencil near the separate leaf is followed by a question mark, so the actual association of the plant fragments mounted on that sheet may be questionable. In any case, judging from morphological characters observable on scanned digital images, both plants belong to the *C. album* aggregate, they were probably hexaploids, and both are not the same as the European specimens of *C. betaceum*.

Of course, at present it is impossible to prove beyond doubt that any of the discussed specimens from the Wallich herbarium at K is indeed associated with one or both names in *Chenopodium* coined by Roth (in Schultes, 1820; also Roth, 1821). However, we may accept the similarity of these plant fragments at K with the standing lectotype at G as circumstantial evidence in favor of the current interpretation of *C. strictum* as some yet obscure morphotype (hexaploid?) of the *C. album* aggregate but not as the priority name for any of Eurasian tetraploids. Thus, one rather widespread species of that tetraploid complex (also represented by *C. striatiforme* Murr, *C. novopokrovskyanum* (Aellen) Uotila, and some other "narrow" species) should be now properly accepted as *C. betaceum* (= *C. striatum*), as it was, first after Andrzejowski (1862), accepted by Chrshanovski (1950) and then confirmed and convincingly justified by Iljin (1952).

The nomenclatural identity of the name *Bassia fiedleri*

Sukhorukov et al. (2019: 106) listed the name *Bassia fiedleri* Aellen (1961: 713) as a new synonym ("syn. nov.") of the accepted name *Bassia scoparia* (L.) A.J.Scott (≡ *Kochia scoparia* (L.) Schrad.) and provided the following comment: "Aellen (in Hegi 1961) stated a new name instead of *Bassia divaricata* (Kar. & Kir.) Kuntze (1891) [now *Grubovia dasyphylla* (Fisch. & C.A.Mey.) Freitag & Kadereit], non *Bassia divaricata* F. Muell. (1882). The name *Bassia fiedleri* was accepted as a synonym of *Grubovia dasyphylla* (Kadereit, Freitag, 2011). However, the analysis of the material in G collected by O. Fiedler in Germany (as an alien plant) and treated by P. Aellen clearly shows that *Bassia fiedleri* is conspecific with *Bassia scoparia*".

The same conclusion is also stated in the Abstract (Sukhorukov et al., 2019: 1): "*Bassia fiedleri*, previously considered as conspecific with *Grubovia dasyphylla*, is added to the synonymy of *Bassia scoparia*".

However, these statements are incorrect. It is evident (and is correctly mentioned by Sukhorukov et al., 2019) that Aellen coined *Bassia fiedleri* as a replacement name for *Echinopsilon divaricatum* Kar. & Kir. Aellen thought that it was necessary to transfer the species name *E. divaricatum* to *Bassia*. However, it was impossible to use for that species-rank taxon the epithet "*divaricata*" because of the existence of the earlier name *Bassia divaricata* (R.Br.) F.Muell. (Mueller, 1882: 30) [≡ *Anisacantha divaricata* R.Brown (1810: 410)] referable to an Australian species now accepted as *Sclerolaena divaricata* (R.Br.) Sm. (see Scott, 1978: 112, Wilson, 1984: 259, etc.), which pre-dates the combination *Bassia divaricata* made by Kuntze (1891: 546) for the Asian species. In his treatment Aellen (1961: 713) clearly stated that his name is "nom. nov." and further specified in the footnote: "*Echinopsilon divaricatum* muß als *Bassia* – wegen der älteren *Bassia divaricata* F. v. Muell., Cens. Austr. Pl. 30 (1882) – einen anderen Namen erhalten" ["*Echinopsilon divaricatum* as *Bassia* got another name – because of the earlier [name] *Bassia divaricata* F. v. Muell., Cens. Austr. Pl. 30 (1882)"].

According to Art. 7.4 of the ICN (Turland et al., 2018), a replacement name (in our case, *Bassia fiedleri*) is typified by the type of its replaced name (here, *Echinopsilon divaricatum*), even though it may have been applied erroneously to a taxon now considered not to include that type.

Indeed, Aellen (1961: 714) also indicated that plants of his *Bassia fiedleri* were collected in Central Europe only once, in 1955 by O. Fiedler, as an alien species introduced with imported wool in Leipzig: "Im Gebiet nur einmal mit Wolle eingeschleppt bei der Leipziger Wollkammerei an einer Schutthalde zahlreich aufgetreten (1955, O. Fiedler)". However, even if these alien plants collected in Germany were misidentified and actually represented *B. scoparia*, as revealed by Sukhorukov et al. (2019), that fact does not give any reason for synonymization of Aellen's replacement name with the latter species.

Consequently, *Bassia fiedleri* (as well as its replacement name *Echinopsilon divaricatum*) is the name homotypic with *Bassia divaricata* (Kar. & Kir.) Kuntze (*nom. illeg.*, non F. Muell. 1882) and a taxonomic synonym of *Grubovia dasyphylla* (Fisch. & C.A.Mey.) Freitag & Kadereit, as it was correctly stated by Kadereit and Freitag (2011). If deemed necessary, "*Bassia fiedleri* auct. non Aellen" can be mentioned under *B. scoparia*, but only as a misapplied name, not as a true synonym.

Comments on typification statements

Acroglochin persicarioides (Poir.) Moq.

The type of the name *Amaranthus persicarioides* Poir. (the basionym of *Acroglochin persicarioides* (Poir.) Moq.) was cited by Sukhorukov et al. (2019: 84) as "not designated, P?". That name and other names associated with *Acroglochin* were discussed by Iamonico (2018), who provided typification information (including newly made lecto- and neotypifications) for all names concerned. However, the article by Iamonico (2018) was published on 14 December 2018, while the article by Sukhorukov et al. (2019) is dated by 31 January 2019. Naturally, it was probably too late to include the article by Iamonico in the list of references in Sukhorukov et al. (2019).

In particular, Iamonico (2018: 199) lectotypified *Acroglochin chenopodioides* Schrad. (cited by Sukhorukov et al. (2019) as "existence [of the type] not certain") on the specimen LE00018195 from Schrader's herbarium and neotypified the name *Amaranthus persicarioides* on the same specimen, thus making these two names homotypic by their lecto- and neotypification.

For the name *Amaranthus diandrus* Spreng., Sukhorukov et al. (2019: 84) reported its type as "Lectotype (Sukhorukov, designated here): NEPAL, Sep 1791, Spreng.[el] (L1677349!)". Iamonico (2018: 199) earlier designated a neotype for that name. A neotype serves as a nomenclatural type only if no original material is extant or as long as it is missing (Art. 9.8 of the ICN: Turland et al. 2018). According to Art. 9.19(a) of the ICN, the choice of a neotype is superseded if any of the original material is found to exist. Thus, the lectotypification made by Sukhorukov, if it is based on an element representing extant original material, supersedes the neotype designation by Iamonico (2018).

Chenopodium karoii (Murr) Aellen

The lectotype of the basionym of that species name, *C. album* subsp. *karoii* Murr (1923: 97), was reported as "Lectotype (designated here by Sukhorukov): [RUSSIA] Nerczynsk [Nerchinsk], dump places, 1892, Karo 169 (G00405813!)" (Sukhorukov et al., 2019: 24). Earlier Uotila and Lomonosova (2016: 226) cited that specimen as the holotype. They admitted that there was no citation of any particular specimen in the protologue (Murr, 1923: 97) but anyway concluded that "Clearly this [i.e. G00405813 – S.M.] is the only sheet that was in Murr's possession and it was used for describing the new subspecies". However, in the context of the current

Shenzhen Code (Turland et al., 2018) and the earlier versions of the *Code* (see further details, comments and recommendations in McNeill, 2014; also Turland et al., 2020) the holotype status of that specimen is not evident. Because of that the formal lectotype designation by Sukhorukov et al. (2019) is justified; nevertheless the reference to the type statement by Uotila and Lomonosova (2016) was desirable.

A proposal to amend the *Code* (Art. 9.10) should be probably considered for cases of original elements erroneously indicated on or after 1 January 2001 as holotypes to be corrected to lectotypes, in addition to the proposal by Turland et al. (2020).

Halogeton glomeratus (M.Bieb.) C.A. Mey. (≡ *Anabasis glomerata* M.Bieb.)

Sukhorukov et al. (2019: 126) reported the type of *Anabasis glomerata* as "Lectotype (designated here by Sukhorukov): Ex Sibiria [From Siberia], Salesow [Zalesov] (LE!)". However, Grubov (1966: 116) provided exactly the same type information: "Описан из «Сибири», тип в Ленинграде" ("Described from «Siberia», type in Leningrad") and further commented that the species was described as based on collections of Zalesov "from Siberia", with no exact location and date given. Grubov also provided brief historical information about travels of Zalesov and suggested that the type specimen in LE originated either from the Lake Zaisan area (eastern Kazakhstan) or from the Chuya Steppe (Altai Republic, Russia). As we see, no new information on the type was provided in Sukhorukov et al. (2019) as compared to the type statement of Grubov (1966; see also Hedge et al. in Freitag et al., 2001: 202), and thus the effective type designation, correctable to lectotype under Art. 9.10 of the ICN (Turland et al., 2018), in that case should be credited to Grubov.

Salsola monopectera Bunge

While discussing *Salsola monopectera*, Sukhorukov et al. (2019: 125) provided the following type statement: "Lectotype (Sukhorukov, designated here): Mongolia chinensis in itineris ad Chinam, [year] 1840 [Tatarinow s.n.] (LE!)". The explanation for the lectotype designation was provided in a note (Sukhorukov et al., 2019: 125): "Note. Bunge (1879) did not state a herbarium for the type specimen. Rilke (1999) and Grubov (2000) indicated that the holotype is in LE, but the Bunge herbarium is also deposited in some other herbaria, especially in G and P. Choosing a lectotype, we follow the suggestion of McNeill (2014) since no collection number and herbarium are indicated in the protologue".

The statement is based on the misunderstanding or misinterpretation of the recommendations provided by McNeill (2014). In fact, Art. 9.10 of the ICN (Turland et al., 2018) is directly applicable in this case: "The use of a term defined in the Code (Art. 9.1, 9.3 and 9.5–9.9) as denoting a type, in a sense other than that in which it is so defined, is treated as an error to be corrected...". Already in 1936, Iljin (1936b: 216) indicated that the type of *S. monoptera* is in LE ("Тип в Ленинграде") and Grubov (1966: 83) confirmed that and provided more details relevant to the type (in Russian: "Описан из Монголии (на пути между городами Калганом и Улан-Батором), тип в Ленинграде", meaning "Described from Mongolia (on the way between Kalgan and Ulan-Bator [Ulaanbaatar] towns), the type is in Leningrad"), but without citing the actual specimen more precisely. Rilke (1999), in turn, referred to these two publications, but also cited the LE specimen (as "holotype"). Thus, the lectotypification of the name *S. monoptera* proposed by Sukhorukov (in Sukhorukov et al., 2019: 125) was unnecessary because the "holotype" (or **the** holotype) from LE indicated by Rilke (1999: 103) and later by Novoselova (2000: 91) in Grubov (2000) (but not directly by Grubov, 2000) is correctable to the lectotype, and that lectotypification should be thus credited to Rilke.

Even if there are two or more original specimens available in LE, Rilke's statement in her monograph of 1999 should be accepted as the first-step lectotypification; however, currently there is no information on the existence of any additional original specimens in LE. Since that type indication/designation has been made by Rilke before 1 January 2001 (Art. 7.11 of the ICN), the phrase "designated here" (*hic designatus*) or an equivalent was not necessary.

Concluding remarks

An earlier version of this article (which was, however, quite close to the present version) was submitted in August 2020 to a journal but was promptly (in just five days after the submission date) rejected following a recommendation in an open review by one of the authors whose opinions and some taxonomic and/or nomenclatural decisions are discussed or corrected here. We assume that such reviewing practice is not the best model to be followed, but anyway, we respect and accept the editorial decision. We emphasize that our intention was to provide to the users of botanical information the nomenclaturally correct solutions for selected taxa in strict accordance

with the current rules of nomenclature (*Shenzhen Code*, Turland et al., 2018) and to express, freely and openly, our opinions on several taxonomically problematic cases. The reviewer complained that some nomenclatural opinions on several taxa have been already expressed, at least in part, in earlier publications by Mosyakin and co-authors (e.g., Mosyakin, 2017; Mosyakin, McNeill, 2018; Mosyakin, Mandák, 2018a, b). In fact, here we provide additional (both direct and indirect) evidence for several noteworthy cases, as compared to arguments presented in our earlier articles, but since our earlier arguments were ignored (at least partly) or probably went unnoticed, we considered it useful to emphasize and further strengthen those arguments here. Nothing personal, just science.

Acknowledgements

The authors are grateful to the reviewers for their useful comments and suggestions, in particular, to Peter J. de Lange (Environment and Animal Sciences, Unitec Institute of Technology, Auckland, New Zealand) for his editorial recommendations. We are grateful to Binod Kumar Singh (ICAR-Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh, India) for providing additional photographs of plants belonging to two Kashi Bathua cultivars from India. Ganna V. Boiko and Vera P. Hayova (M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine, Kyiv, Ukraine) skilfully guided the present submission through the editorial process and made several improvements to the text and images. The taxonomic and nomenclatural work of Sergei Mosyakin was in part supported by the National Academy of Sciences of Ukraine (project 0117U004024) and research of Bohumil Mandák was supported by the Ministry of Education, Youth and Sports of the Czech Republic (LTAUSA18004), the Czech Science Foundation (20-20286S), and is part of the long-term research development project RVO 67985939.

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Recommended for publication by N.M. Shyian