Notes on the morphology and taxonomy of *Chenopodiastrum* (Chenopodiaceae/Amaranthaceae s. lato), with two new combinations, *C. erosum* from Australia and *C. gracilispicum* from China

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An emended description of *Chenopodiastrum* S. Fuentes, Uotila & Borsch, a small segregate genus of the heterogeneous Linnaean genus *Chenopodium*, is provided and morphological characters used in the generic description are evaluated. Two species are transferred from *Chenopodium* to *Chenopodiastrum* for which two new combinations, *Chenopodiastrum erosum* (R. Br.) Uotila and *C. gracilispicum* (H.W. Kung) Uotila, are made. The descriptions of these species are emended and their relationships within the genus discussed.

Introduction

The large, heterogeneous Linnaean genus *Chenopodium* (Chenopodiaceae, sec. Hernández-Ledesma *et al.* 2015; Amaranthaceae, sec. The Angiosperm Phylogeny Group 2016) was recently divided into several segregate genera (Fuentes-Bazan *et al.* 2012b), including the new genus *Chenopodiastrum* S. Fuentes, Uotila & Borsch. *Chenopodiastrum* is a widespread but small genus, and originally only five species were included in it: the Eurasian *C. hybridum* (L.) S. Fuentes, Uotila & Borsch and the related *C. badachschanicum* (Tzvel.) S. Fuentes, Uotila & Borsch from Central Asia and *C. simplex* (Moq.) S. Fuentes, Uotila & Borsch from North America, the Macaronesian endemic *C. coronopus* (Moq.) S. Fuentes, Uotila & Borsch, and

the widespread *C. murale* (L.) S. Fuentes, Uotila & Borsch. Later Mosyakin (2013) added an East African endemic species, *C. fasciculosum* (Aellen) Mosyakin. Morphologically the *Chenopodiastrum* species fall into two rather distinct groups, traditionally treated as sections or subsections in *Chenopodium* (see Mosyakin 1993, 2003). Mosyakin (2013) transferred the sectional grouping to *Chenopodiastrum*. This division receives some support also from molecular analysis (Fuentes-Bazan *et al.* 2012b), but only limited material was analyzed.

Chenopodiastrum is a largely molecular-based genus and morphologically heterogeneous, and it was difficult to find reliable common morphological features for the genus and to separate it from *Chenopodium* s. stricto (Fuentes-Bazan *et al.* 2012b). The genus is still not well understood

and the aim of the present study is to find out if there might be unused morphological features characterizing the genus and distinguishing it from the other segregate genera of *Chenopodium* *s. lato*, especially from the core genus *Chenopodium*. In the course of checking the relevance of observed new generic characters it became necessary to move some species from *Chenopodium* to *Chenopodiastrum*. In this paper one Asiatic and one Australian species are transferred to *Chenopodiastrum*. In addition, the descriptions of the genus and the transferred species are emended on the basis of new observations.

Material and methods

The present study is a continuation of long-lasting research on *Chenopodium s. lato* (see Uotila & Lomonosova 2016) and is based mainly on herbarium specimens in BM, G, H, K, LE and P, revised in the 2010s. The virtual herbaria of Australia (AVH, <http://avh.chah.org.au>), New Zealand (NZVH, www.virtualherbarium.org.nz) and China (CVH, <http://www.cvh.ac.cn/>) were consulted in 2017.

Genus *Chenopodiastrum*

Annual herbs, non-aromatic, but with characteristic smell in at least the species studied in fresh condition; young stems, leaves (especially below) and inflorescence with short- and thin-stalked vesicular trichomes and sparsely-distributed, articulated, non-vesicular trichomes; later the hairs, especially the bladder, usually collapse completely and the plants become mostly glabrescent. Stem erect to ascending, hard, angular or strongly ridged, sometimes subangular with low band-like stripes; branches short to fairly long, basal ones often long, subopposite, secondary branches few, rather short. Leaves alternate, lower leaves sometimes subopposite, with petiole usually shorter than blade; blade usually fresh green (not glaucous or greyish), (broadly) triangular or ovate to rhombic-ovate, entire with entire or variously dentate to variously lobed margins, or pinnatifid with narrow, dentate lobes, base broadly cuneate or broadly attenuate to truncate

or slightly cordate, apex acute to short-acuminate; upper leaves narrower, often lanceolate, mostly less dentate and lobed or entire.

Inflorescences terminal and axillary, mostly panicle-like, sometimes spike-like, leafy, bracteate or ebracteate, partial inflorescences mostly ebracteate, fairly short to elongated, flowers in small glomerules (cymes) and in part solitary. Flowers dimorphic, bisexual or pistillate. Perianth segments 5, basally connate 1/3–2/3; margin entire to apically slightly dentate-laciniate, apex acute–obtuse–truncate; midrib visible and usually elevated inside; back fairly flat near the base but keeled towards the apical part and ending with a more or less prominent boss near the apex, remaining cup-shaped and enclosing most of the fruit or spreading and reflexing in fruit. Stamens 5. Stigmas 2, short. Fruit one-seeded, falling with the perianth or detached from it; pericarp membranous with rough papillae, firmly adherent to or easily removable from the seed or sometimes loose on the seed. Seeds horizontal, lenticular, ± round in outline, margin ± acute and usually with a narrow, flat, wing-like rim, in some species more obtuse and without a rim; seed-coat black, lustrous, foveate or erose to reticulately pitted or ± rugulose or almost smooth, usually with radial striations.

Notes on diagnostic characters

Smell

All *Chenopodiastrum* species studied in fresh condition (*C. badachschanicum*, *C. coronopus*, *C. hybridum* and *C. murale*) have a characteristic spicy smell, which can be easily detected by rubbing fresh leaves with the hand. It is especially prominent in *C. hybridum*. In some cases strong smell has been mentioned on the labels of specimens (e.g. *C. erosum*) and possibly the smell is characteristic for the genus. The smell disappears soon when the leaf starts to dry and it cannot be restored by moistening the dried leaf. The numerous species of *Chenopodium* and *Oxybasis* studied in fresh condition have a different smell, mostly quite weak, except for the offensive smell characteristic of e.g. *Chenopodium vulvaria*, which can be renewed by

moistening dried plant material and rubbing it between finger and thumb. The aromatic smell of the species of *Dysphania* is very different from the spicy smell of *Chenopodiastrium*.

Trichomes

Young parts of the shoot, stem, rachis, leaves and flowers often have an abundance of vesicular trichomes in *Chenopodium* and not so many in *Chenopodiastrium*, *Oxybasis*, *Blitum* and *Lipandra*. Stems and leaves later tend to become glabrescent, especially in the last three genera. The vesicular hairs have a larger bladder cell and short stalk of one to few stalk cells. In *Chenopodiastrium* the bladder is often slightly yellowish or slightly brownish and later completely collapses, and the whole trichome detaches easily; an exception is *C. gracilispicum*, the trichomes of which are fairly permanent on the lower leaf surface. The species of *Oxybasis* are still more glabrous than those of *Chenopodiastrium*, except for *O. glauca* and *O. macrosperma*, which have a dense, $\pm$ permanent cover of vesicular trichomes on lower leaf surfaces as in *Chenopodiastrium gracilispicum*. The vesicular trichomes in *Chenopodium* are white, more permanent and often only the upper half of the bladder is lost while the lower half remains for longer as a cup.

Reimann and Breckle (1988) studied hairs of 24 species of *Chenopodium s. lato*, which represent all the segregate genera distinguished at present, except for *Teloxys*. They recognized and illustrated three hair types, namely glandular hairs, articulated hairs and vesicular hairs, and among the vesicular hairs they found differences in the bladder cell size and number and morphology of the stalk cells. The species, which at present belong to *Chenopodiastrium* (*C. murale* and *C. hybridum*), *Blitum* (3 species), *Oxybasis* (4 species) and *Lipandra* (1 species) had small bladder cells (max. 80 μm in diameter) and several stalk-cells with vacuoles but which were not gland-like, in contrast with the eight studied species of *Chenopodium s. stricto*, which had larger bladder cells (max. 130–165 μm) and almost always only one gland-like stalk cell. Stalk cells were cutinized in *Chenopodium s. stricto* but not in the others. Moreover, articulated non-vesicu-

lar hairs were present in *Chenopodiastrium* and other segregate genera, but not in *Chenopodium s. stricto*. Glandular hairs were restricted to a group of species now in *Dysphania*.

Stems

In most of *Chenopodiastrium* species the stem is provided with prominent and rather sharp ridges, which make the stem feel angular between finger and thumb, especially in dried specimens. However, the stem of *C. murale* is often only subangular with low band-like striae. The ridged stem has been mentioned in original descriptions and Flora treatments of some species at present in *Chenopodiastrium*, but its importance has been undervalued. Stems in *Chenopodium s. stricto* and *Oxybasis* are $\pm$ terete and they often have low band-like green striae. However, stems of some *Chenopodium* species have low rounded ridges, and a few Australian species, formerly belonging to the genus *Einadia*, are said to have ridged stems (Wilson 1983). In *Lipandra* stems are often $\pm$ quadrangular.

Leaves

Leaf size and shape vary considerably between *Chenopodiastrium* species, and the variation seems to be wider than within *Chenopodium s. stricto*. However, leaf shape is relatively constant within a species, taking into consideration the leaf sequence. Leaves of *Chenopodiastrium* are mostly fresh green and differ from *Chenopodium s. stricto*, in which glaucous or greyish green leaves are common. Red coloration on leaves and stems is more or less common in *Oxybasis*, *Lipandra*, *Blitum* and *Chenopodium* but more exceptional in *Chenopodiastrium*.

Inflorescence and flowers

The inflorescence in *Chenopodiastrium* is basically similar to that in *Chenopodium s. stricto*, but in the former genus the number of flowers in a glomerule is usually lower, often only 2–4. In *Chenopodiastrium* the main and secondary

branches of the inflorescence are typically relatively short but often widely spreading. However, in both genera the variation in the habit of the inflorescence is considerable great both between and within the species.

In *Chenopodium* and segregate genera flower dimorphism exists especially between the apical flower and lateral flowers of a cyme: the apical flower is usually hermaphrodite, whereas the lateral flowers are often female. In *Blitum* and *Oxybasis* even the seed position can be different: seeds of apical flowers are horizontal, the others mostly vertical. In *Chenopodiastrum* the flower dimorphism appears especially in *C. hybridum* and allied species. In their hermaphrodite apical flowers and single flowers in axils of the rachis branches, the perianth splits about 3/4–4/5 of its length and the lobes are reflexed in fruit and with inrolled margins and almost hooked apex. The fruit is shed without the perianth, which persists for a considerable time as a conspicuous, whitish star-like structure. In lateral flowers the perianth splits to ca. midway, with broad whitish membranous margins and notched apex, and remains cup-shaped. At least some of the fruits of such flowers are shed with the perianth. In *Chenopodium s. stricto* apical and lateral flowers do not differ markedly from each other in the perianth morphology.

Perianth

The perianths of *Chenopodiastrum* species differ quite clearly from those of the species in *Chenopodium s. stricto* and other segregate genera. In *Chenopodiastrum* each perianth-lobe has a strong midrib, which is clearly visible and often elevated inside. There may exist a correlation between a strong midrib and the tendency to reflexing perianth-lobes. In *Chenopodium s. stricto* the perianth-lobes have a weaker midrib and in general the perianth remains cup-shaped and mostly falls with the fruit. In *Oxybasis* the tendency to prominent midrib and spreading perianth-lobes can be seen in *O. micrantha* (Sukhorukov *et al.* 2013).

Furthermore, in *Chenopodiastrum* the back of a perianth lobe, quite flat in the basal part, is gradually elevated towards the apex, where it forms a distinguishable boss. In *Chenopodium s.*

stricto many species have a fairly rounded back, but in addition the lobes may have a prominent wing-like keel on the back. In such cases the keel is more evenly distributed along the back and most prominent in the middle, usually gradually diminishing towards the apex and lacking any boss near the apex. In other genera the back is usually weakly elevated if at all and without an apical boss. The perianth lobes of *Chenopodiastrum* have membranous, finely ciliate-dentate margins and the apex is obtuse or notched to slightly erose; the membranous margins of perianth lobes in *Chenopodium s. stricto* and other genera are entire and the apex acute, obtuse or at most notched but not erose. Strongly succulent perianths are developed in some *Blitum* species but not in other genera.

Pericarp

Both in *Chenopodiastrum* and most of *Chenopodium s. stricto* the fruit wall (pericarp) is $\pm$ colourless or sometimes greenish, non-succulent and formed of several undifferentiated layers of parenchymatous cells, while the surface is covered with papillae, but in *Chenopodiastrum hybridum* and related taxa the papillae do not react in the same way as in *Chenopodium* when dry papillae are soaked (Sukhorukov & Zhang 2013). The new members of *Chenopodium s. stricto*, transferred from the former Australian genera *Einadia* and *Rhagodia* (Fuentes-Bazan *et al.* 2012a), have a succulent pericarp (Wilson 1983). In *Chenopodiastrum* the adherence of the pericarp varies considerably between species: it can be almost detached from the seed, persistent but readily scraped off, or tightly adherent to the seed-coat in particular in the bottoms of pits. In general, smoother seeds have a looser pericarp and most of the plants with pitted seeds have a strongly adherent pericarp. However, sometimes plants with clearly pitted seeds may have even a fully detached pericarp.

Seeds

Seed size in *Chenopodiastrum* varies from 1 to > 2 mm; instead most *Chenopodium* species

have seeds < 1.5 mm, even < 1 mm and hardly ever up to 2 mm; in *Oxybasis* the seeds are still smaller. Seeds of *Chenopodiastrium* have a more or less round outline, but seeds of *Chenopodium s. stricto* are often slightly longer than broad, sometimes round. In most *Chenopodiastrium* species the seed margin has a characteristic narrow, sharp rim. However, such a rim is absent from *C. hybridum* and closely related taxa, and from *C. erosum*; their seeds have an acute to obtuse edge. The seeds of *Chenopodium* species have typically rounded to slightly acute margins but without a proper rim. In *Oxybasis* two species, *O. gubanovii* and *O. micrantha*, have seeds with a narrow rim (Suchorukow 1999, Sukhorukov *et al.* 2013).

In *Chenopodiastrium hybridum* the seed-coat appeared to be relatively thick in comparison with *C. murale* and other genera (Sukhorukov & Zhang 2013). Seed surface varies considerably between the species of *Chenopodiastrium*, from almost smooth (*C. simplex*, *C. gracilispicum*) to slightly rugulose (*C. badachschanicum*), reticulate-pitted (*C. coronopus*, *C. fasciculosum*, *C. murale*), coarsely reticulate-pitted (*C. hybridum*) to erose (*C. erosum*). In *Chenopodium s. stricto* the seed surface varies mostly from smooth to only shallowly and minutely pitted; however, a few species (e.g. *C. berlandieri*, *C. ficifolium*, *C. hircinum*) have a distinctly and $\pm$ reticulately pitted seed-coat, and several Australian species, mostly those transferred from *Einadia* and *Rhagodia*, have very variable seed-coats, including deeply pitted and erose ones. In the other segregate genera seeds are mostly fairly smooth.

New transfers

Chenopodiastrium erosum (R. Br.) Uotila, *comb. nova*

BASIONYM: *Chenopodium erosum* R. Br., Prodr. Fl. Nov. Holland.: 407. 1810. — *Oxybasis erosa* (R. Br.) Mosyakin, Phytoneuron 2013-56: 5. 2013. — TYPE (lectotype, designated by Wilson 1983): Island of Kent group, Bass Strait, December 1804, R. Brown (BM001010197!; image at <http://plants.jstor.org/stable/10.5555/al.ap.specimen.bm001010197>). Isotypes at BM! and K!.

Stems to 100(–150) cm, erect, with prominent, narrow ridges, usually with long basal, subopposi-

site, ascending branches, upper branches short. Young stems, leaves and inflorescence vesicular-hairy, later glabrescent. Leaves with petiole usually much shorter than the blade; blade thin, green, 3–15 cm, triangular to ovate, irregularly dentate to lobed, lobes and teeth $\pm$ spreading, base $\pm$ truncate, apex acute to acuminate; upper leaves narrower, but still with a truncate base and roughly dentate. Inflorescences axillary and terminal, leafy, partial inflorescences formed of ebracteate, cymosely arranged, small glomerules on short branches, sometimes more elongated and the inflorescence lax, diffuse. Perianth lobes 5, at least 1/3 of the perianth length, narrowly triangular; margins narrowly membranous and minutely ciliate at the edge; apex truncate to obtuse; back somewhat swollen with a small, distinct boss in apical part; mid-vein broad, swollen and prominent inside. Stamens 5. Stigmas 2, short. Fruits falling with or without the widely opened fruiting perianth; pericarp persistent, closely attached to the seed. Seeds horizontal, 1.2–1.5 mm, round in outline, fairly flat; margin $\pm$ acute, without a rim; seed-coat roughly, irregularly eroded.

DISTRIBUTION AND HABITAT ECOLOGY. *Chenopodiastrium erosum* is known only from Australia and New Zealand. It is native at least to Australia, but sometimes it was regarded as an early introduction to these countries, maybe on account of its usual status as a weed. *C. erosum* has a limited distribution in southwestern Australia (Victoria, southernmost South Australia, southwest of Queensland and New South Wales; maps in Wilson 1983, 1984, Walsh 1996 and AVH 2017), and it is classified as rare or vulnerable there (VicFlora 2015, <https://vicflora.rbg.vic.gov.au/>). The type collection is from northernmost Tasmania, close to the core area in Victoria, but the species has not been reported from the islands more recently and at present it is regarded as extinct in Tasmania (Threatened Species Section 2017, <http://www.threatenedspecieslink.tas.gov.au/Pages/Chenopodium-erosum.aspx>). *Chenopodiastrium erosum* has been reported also from the South Island of New Zealand, as early as 1875 (Webb *et al.* 1988; map in NZVH 2017). The species has been collected infrequently in both countries and reported as rare.

Habitats of *Chenopodiastrium erosum* are riverbanks and forestlands, and it is often promi-

nent on disturbed bare soils, either in recently burnt areas or in areas modified by humans such as fields, roadsides, paths and landscaped areas. On some labels occurrences have been regarded as apparently fire-promoted (AVH 2017). This species may have a durable seed bank as noted, e.g., for *Chenopodium album* and several other Chenopodiaceae (see Baskin & Baskin 2001), which may explain quite frequent occurrences on burnt or otherwise disturbed soils.

NOTES. Brown (1810) cites *Chenopodium erosum* from two places: “*Insulam van Diemen*” and “*Oram Meridionalem Novae Hollandiae*”. The original herbarium material includes at least five specimens, two in BM (BM001010197–8!), two in K (000898453–4!) and one in P (P05391196!). The specimens in BM and K are from the Kent Group Islands, Tasmania, and were collected by Robert Brown during his *Iter Australiense*, in 1802–1805; they obviously belong to a single collection. Paul G. Wilson had seen the specimens at BM, and indicated them as a holotype and an isotype, more correctly lectotype and isolectotype. Further isolectotypes are present at K. The specimen in P is collected from *Nova Hollandia* and refers to the other locality given by Brown. The specimen originates from “*Herb. Fée*” [Antoine Laurent Apollinaire Fée (1789–1874), a French botanist], belongs to *Herbarium Moquinianum*, and it is cited by Moquin-Tandon (1840, 1849).

Wilson (1983) noted the fact that *C. erosum* is a unique member of *Chenopodium* (*s. lato*) in the Australian native flora. He did not draw attention to its similarity to *C. murale*, another member of the genus and which is quite common in Australia, but interpreted as a probable early introduction to the country (Wilson 1983). However, specimens of *C. erosum* were earlier often misidentified as *C. murale*, and the species was included in *C. murale* in local floras (e.g. by Bentham & Mueller 1870). Even Moquin-Tandon (1840, 1849) saw affinities between these species and placed it between *C. murale* and *C. hybridum*. Webb *et al.* (1988) mention possible relationships to *Chenopodium urbicum* (= *Oxybasis urbica*) and many specimens were originally determined as *Chenopodium urbicum*. Recently Mosyakin (2013) moved *C. erosum* to *Oxybasis*. However, *C. erosum* clearly differs from the spe-

cies of *Oxybasis*, which have $\pm$ smooth, terete stems, perianths lacking an apical boss, and different seed position, size and shape.

Chenopodiastrum erosum shows most of the typical features of the genus: the stem is prominently ridged (noted also in Breitwieser *et al.* 2010), vesicular hairs collapse completely, perianth lobes have a prominent midrib visible inside and the back has a small but distinct apically elevated boss, and the seeds are fairly large, almost round. The strongly eroded-pitted surface of the seed is exceptional in the genus, resembling most the deeply and roughly reticulate-pitted seed-coat of *C. hybridum*. Even the $\pm$ triangular leaves with irregular spreading lobes are unique in the genus, but sometimes superficially resembling quite closely the leaves of *C. murale*. A note on the label of a specimen (Walsh 5994, CANB) “Leaves rank-smelling” possibly indicates that *C. erosum* has the characteristic smell of *Chenopodiastrum*.

Chenopodiastrum gracilispicum (H.W. Kung) Uotila, *comb. nova*

BASIONYM: *Chenopodium gracilispicum* H.W. Kung, Acta Phytotax. Sin. 16(1): 120. 1978. — HOLOTYPE: China. Zhejiang, Tianmu Shan, 31 July 1930, T.N. Liou 322 (PE 00024038; Image at <http://www.cvh.ac.cn/ms/PE/00024038>; photograph of the sheet in Kung *et al.* (1978).

Stems 40–70 cm, erect, slender, hard, terete, ridged, fairly sparsely branched, branches often subopposite. Leaves alternate but lower stem leaves subopposite; petiole slender, slightly shorter than or as long as the blade; blade to 4.5 cm, narrower than or sometimes as broad as long, rhombic to broadly triangular-ovate, often with basal angles or with a short, outward-projecting lobe near the base on both sides, otherwise margins entire; above green and sparsely hairy, later glabrescent, below greyish green and with abundant vesicular trichomes, in which the cup is fairly persistent after collapse of the bladder; base broadly cuneate-attenuate to $\pm$ truncate; apex shortly acuminate. Inflorescence terminal and axillary, partial inflorescences arranged into ebracteate, interrupted spikes on main axis and slender branches, glomerules small. Perianth lobes narrow, united only at base, in seed stage

only partially covering the fruit but not spreading; margin narrowly membranous, slightly dentate near the apex; apex acute to obtuse, often notched; back apically keeled; midrib visible but not elevated inside. Stamens 5. Stigmas 2. Fruit falling with the perianth; pericarp mostly easily removable from the perianth. Seed horizontal, 1.1–1.5 mm, round in outline, fairly flat, margin fairly obtuse to acute and with narrow wing-like rim; seed-coat shiny black, with obscure radial striae and shallow small pits, sometimes rugulose.

DISTRIBUTION AND HABITAT ECOLOGY. According to Zhu *et al.* (2003) and images of specimens (CVH 2017, <http://www.cvh.ac.cn/>), *C. gracilispicum* is relatively common in China and known from S Gansu, Guangdong, Hebei, Henan, Hunan, Jiangsu, Jiangxi, Shaanxi, E Shandong, Sichuan, Taiwan and Zhejiang. Zhu *et al.* (2003) also cite the species as present in Japan. According to Zhu *et al.* (2003) and herbarium labels *C. gracilispicum* is reported from forest margins, bamboo forests, grasslands and river banks; probably it is not weedy to the same extent as many *Chenopodium* species.

NOTES. The ridged stem, referred to as ribbed by Zhu *et al.* (2003), perianth lobes with apical boss and seeds with distinct rim on the margin clearly indicate the genus *Chenopodiastrum*. The tendency to subopposite branches and lower leaves is more pronounced than in other species of *Chenopodiastrum* and in *Chenopodium s. stricto*. The more or less entire leaf blade is unusual in other species of *Chenopodiastrum*, but on rare occasions ovate, entire leaves have been seen in *C. simplex*. The seed-coat closely resembles that of *C. simplex* and *C. badachschanicum*. The inflorescence is very loose with long branches, approaching extreme forms of *C. badachschanicum*.

Chenopodium bryoniaefolium in Flora of Japan (Ohwi 1965) may include misidentified *Chenopodiastrum gracilispicum*; ‘seeds keeled on the margin’, given in the description of *C. bryoniaefolium* in the Flora, points to *C. gracilispicum*. In leaf size and shape these species may be quite similar, but the leaves of *C. bryoniaefolium* usually have more prominent basal lobes and more rounded apices and lobes, whereas the lobes are acute or often completely absent from the leaves of *C. gracilispicum*.

Even Chinese specimens have been occasionally misidentified as *C. bryoniaefolium*. Moreover, according to Zhu *et al.* (2003) the name *Chenopodium koraiense* Nakai, synonym of *C. bryoniaefolium*, has been misapplied to *C. gracilispicum*.

Discussion

A few new morphological characters, apparently characterizing the genus, have been detected in the studied species and specimens of *Chenopodiastrum*. They include the smell in fresh condition, stem shape, features of perianth-lobes and seeds and micromorphology of the trichomes. However, so far all the species of *Chenopodiastrum* and *Chenopodium s. stricto* in particular have not been studied extensively enough to evaluate properly the importance of these characters in the generic taxonomy of *Chenopodium s. lato*.

In gross morphology *Chenopodiastrum erosum* and *C. gracilispicum* deviate quite considerably from each other and from previously accepted members of *Chenopodiastrum*. However, both have several characters, familiar in the genus, such as ridged stems and apically keeled perianth lobes with clearly visible midrib inside.

Despite its slender and sparingly branched habit *C. gracilispicum* seems to be related to the Asiatic *C. badachschanicum* and N American *C. simplex* and fits better in *Chenopodiastrum* sect. *Grossefoveata* than *C. sect. Chenopodiastrum*. As to *C. erosum*, the wingless seed margin and eroded seed surface might represent an extreme case of deeply and roughly pitted seed surface of *C. hybridum*. Even the strongly ridged stem and spreading perianth lobes match the species of *C. sect. Grossefoveata*. On the other hand its general habit and inflorescence call to mind more readily *C. murale* than *C. hybridum*. So, these new members of *Chenopodiastrum*, as well as *C. fasciculosum*, upset to some extent the traditional morphological character combinations of the sections, and their position in the sectional division needs confirmation by molecular analysis. This recommendation applies to the sectional division as a whole. Only four species were included in the analysis by Fuentes-Bazan *et al.* (2012b), and the division needs to be confirmed

by analyzing preferably all the species belonging to the genus.

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