# NOMENCLATURAL CHANGES IN THE GENUS *POLYGONUM* SECTION *POLYGONUM* (POLYGONACEAE)

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## ABSTRACT

Five new combinations are proposed in the genus *Polygonum* s. str. for the forthcoming treatment of Flora of North America: *P. aviculare* subsp. *buxiforme*, *P. fowleri* subsp. *hudsonianum*, *P. humifusum* subsp. *caurianum*, *P. ramosissimum* subsp. *prolificum* and *P. striatulum* var. *texense*. The taxonomy of each taxon is briefly discussed and a diagnostic table is provided for the subspecies of *Polygonum aviculare*.

## RESUMEN

Se proponen cinco nuevas combinaciones en el género *Polygonum* para el futuro tratamiento de este género en la Flora de Norteamérica: *P. aviculare* subsp. *buxiforme*, *P. fowleri* subsp. *hudsonianum*, *P. humifusum* subsp. *caurianum*, *P. ramosissimum* subsp. *prolificum* y *P. striatulum* var. *texense*. La taxonomía de cada taxon se discute brevemente y se incluye una tabla diagnóstica para las subespecies de *Polygonum aviculare*.

## INTRODUCTION

During the preparation of *Polygonum* s. str. for Flora of North America it was concluded that several new combinations are required to reflect the new taxonomic knowledge in this genus. The changes involve *P. buxiforme* Small, *P. hudsonianum* (Wolf & McNeill) Hinds, *P. caurianum* Robinson, *P. prolificum* (Small) Robinson and *P. texense* M.C. Johnston.

### 1. Polygonum aviculare complex

*Polygonum aviculare* is a taxonomically controversial polyploid complex of predominantly selfing annuals. Lindman (1912) recognized two species: *P. heterophyllum* (= *P. aviculare* subsp. *aviculare*) and *P. aequale* (= *P. aviculare* subsp. *depressum*), while Chrtek (1956) accepted only one species, *P. aviculare*, with several subspecies. However, European and North American taxonomists have frequently recognized several distinct species within this complex: *P. aviculare* s.str., *P. arenastrum* Boreau, *P. boreale* Lange, *P. rurivagum* Jord. ex Boreau, *P. neglectum* Besser and *P. buxiforme* Small (e.g. Styles 1962; Mertens & Raven 1965; Scholz 1977; Wolf & McNeill 1986). The recognition of the former four species has been mainly based on Styles (1962) who studied British popu-

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lations. Styles (1962) found these four species to be morphologically discontinuous and with different chromosome numbers: *P. aviculare* and *P. rurivagum* were hexaploids (2n = 60), while *P. boreale* and *P. arenastrum* were tetraploids (2n=40). Studies done in North America initially confirmed these observations and the recognition of these species relied heavily on these different chromosome numbers (e.g. Mertens & Raven 1965; Moore et al. 1970; McNeill 1981). More recent studies have challenged both the morphological and the cytological criteria. Multivariate analysis and isoenzyme studies using many populations have proved that these taxa are not well-differentiated and populations with intermediate characteristics may occur (Meerts et al. 1990). Other chromosome counts, obtained both in Europe and North America, reported hexaploid populations among *P. arenastrum* and tetraploids among *P. aviculare* (e.g. Gasquez et al. 1978; Wolf & McNeill 1987; Meerts et al. 1998). Isoenzyme studies showed that the *P. aviculare* complex has probably an allopolyploid origin (Meerts et al. 1998) and it has evolved as a swarm of inbreeding lines ("Jordanons") (Gasquez et al. 1978). Yurtseva (2001) suggested that the patterns of variation in the pericarp surface support the hybrid origin of some species. For example, *P. arenastrum* presumably originated as a hybrid between *P. aviculare* and *P. calcatum* (= *P. aviculare* subsp. *depressum* in this study). *Polygonum neglectum* resulted from the hybridization of *P. aviculare* and *P. arenastrum*. Although the members of *P. aviculare* are predominantly inbreeders, some structures that make possible cross-pollination in other Polygonaceae are present here as well. Cleistogamous and chasmogamous flowers, the heterostyly, protandry, and the capacity to secrete nectar may be regarded as remnants of an ancestral mixed mating system (Costea and Tardif, unpublished). Bugg et al. (1987), Yurtseva (1998) reported that flowers of *P. aviculare* agg. are frequently visited by insects and thus introgression may occur to some extent. This would explain the complex intermediate variation patterns that occur between its members. In such conditions, recognition of these taxa at species level is unrealistic and unpractical. The subspecific rank is proposed for *P. buxiforme* because of the intermediates observed mainly with *P. aviculare* subsp. *aviculare*.

**Polygonum aviculare** L. Sp. Pl.:359. 1753 subsp. **buxiforme** (Small) Costea & Tardif, comb. et stat. nov. (**Fig. 1.**). BASIONYM: *Polygonum buxiforme* Small, Bull. Torrey Bot. Club 33:56. 1906. *Polygonum littorale* auct., non Link; *Polygonum aviculare* var. *littorale* auct., non Mertens & Koch; TYPE: U.S.A. VIRGINIA. LEE CO.: about Cumberland Gap, 27 Jul 1892, *J.K. Small s.n.* (LECTOTYPE formally designated here, Katz & McNeill, in herb 1988, NY 323754!).

*Polygonum buxiforme* f. *montanum* Brenckle, Phytologia 3:363. 1950.

*Polygonum aviculare* includes at least six subspecies in North America, which are distinguished only by a combination of characters (Table 1). Some extensively employed characters may be misleading if not examined properly. Heterophylly has been considered by all authors an important feature that distinguishes for


FIG. 1. *Polygonum aviculare* subsp. *buxiforme*; the lectotype. (*J.K. Small s.n.* NY 323754.)

TABLE 1. Comparison between the subspecies of *Polygonum aviculare*. Mature early season plants with leaves, flowers and achenes are necessary for accurate determinations. Measurements of leaves and ochreas were made at the middle of main stem. Description of perianth refers to fruiting perianth, which was measured from the joint with the pedicel. Description of achene uses the terminology of Wolf and McNeill (1986).

| | Polygonum aviculare subspecies | | | | | |
|---|---|---|---|---|---|---|
| **Characters** | **ssp. aviculare**<br>= *P. monspeliense* Pers.<br>= *P. heterophyllum* Lindm. | **ssp. boreale** (Lange) Karlsson<br>= *P. boreale* Lange | **spp. buxiforme** (Small) Costea and Tardif | **ssp. rurivagum** (Jord. ex Boreau) Berher<br>= *P. rurivagum* Jord. ex Boreau<br>= *P. aviculare* var. *angustissimum* Meisn. | **ssp. neglectum** (Besser) Arcang.<br>= *P. neglectum* Besser<br>= *P. aviculare* ssp. *rectum* Chrtek | **ssp. depressum** (Meissn.) Arcang.<br>= *P. aviculare* ssp. *microspermum* (Jord. ex Boreau) Berher<br>= *P. arenastrum* Boreau<br>= *P. aequale* Lindm.<br>= *P. calcatum* Lindm.<br>= *P. microspermum* Jord. ex Boreau.<br>= *P. montereyense* Brenckle |
| **STEMS;** Number<br>Position of main stems | 1–3<br>ascending–erect; rarely procumbent | 1–6<br>procumbent-ascending | 1–3 or numerous<br>procumbent-ascending | numerous<br>procumbent-ascending | numerous<br>procumbent-ascending; rarely erect | numerous<br>procumbent, rarely ascending |
| **OCREAE;** Size<br>Appearance | (5–)6–10(–12) mm<br>free part soon dissolved into fibers | 3.5–6.5(–8) mm<br>free part disintegrating with almost no fibrous remnants | 3.5–6.5(–8) mm free part silvery, relatively persistent, with inconspicuous veins, after disintegrating with or without fibrous remnants | (6.5–)8–12.5 mm<br>free part with strong and brown veins, persistent after disintegrating | (3.6–)4–8.1mm<br>free part with inconspicuous veins, after disintegrating with almost no fibrous remnants | a) 3–5.5 or b) 8–12 mm<br>**a)** free part with inconspicuous veins after disentegrating leaving almost no fibrous remnants |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | **b)** free part persistent, silvery, overlapping toward the stem and branch apices |
| **LEAVES;** Shape of lamina | elliptic to oblanceolate | spathulate to obovate | elliptic to obovate; narrow elliptic to lanceolate or oblanceolate | very narrow-elliptic to linear-lanceolate | narrow-elliptic to oblanceolate | elliptic to narrow-elliptic or oblanceolate |
| Shape of lamina apex | acute or obtuse | obtuse to rounded | obtuse to acute | acute | acute | obtuse or acute |
| Length | (10–)20–55 (–65) mm | (10–)15–45(–50) mm | 6–30(–45) mm | (10–)15–30 mm | (7.5–)12–35(–45) mm | 7.5–30 mm |
| Width | 6–20(–26) mm | 5–20(–26) mm | 3–6(–13) mm | 2.5–5(–9) mm | 2–6(–10) mm | 2–8(–13) mm |
| Ratio length : width | 2–4.5(–5.5) | 2–4(–5) | 2.5–5.6(–10) | (4–)5–13.5(–15) | (3.5–)4.3–8.5(–10) | (2–)2.8–5.5(–9) |
| Ratio length of middle stem leaves and adjacent branch leaves | (1.1–)1.5–4 | (1.1–)1.3–3 | 1-2.5(–3.3) | 1.2–2.4(–3.2) | 1–2.5(–3.3) | 1–2.5(–3) |
| Color | pure green | pure green | gray-green | pure green | pure green | pure green or gray-green |
| Petiole | 1–6.5 mm | 1–7.5 mm | 0.3–2(–3.5) mm | 0.3–2 mm | 0.5–3(–5) mm | 0.5–3.5(–4.5) |
| **CYMES;** Nr. of flowers | (2–)4–8 | (2–)4–8 | 2–6(–8) | 1–3 | 1–4(–6) | (1–)2–5(–8) |
| Distribution of cymes on the stems | congested at the top stems and branches | ± uniformly | ± uniformly, rarely congested at the top stems and branches | ± uniformly; rarely congested at the top stems and branches | ± uniformly | ± uniformly; rarely congested at the top stems and branches |
| **PERIANTH;** Size | (2.3–)2.6–4.8(–5) mm | (3–)3.3–5.5 mm | (2–)2.3–3.4(–3.6) mm | (2–)2.3–3.2 mm | (2–)2.2–3.4(–3.6) mm | (2–)2.2–3.5(–4) mm |
| Ratio length : width | 1.8–2.8 | 1.6–2.8 | 0.9–1.3 (–1.5) | 1.6–2.6 | 1.6–2.6 | 1.5–2.9 |

TABLE 1. continued

| | Polygonum aviculare subspecies | | | | | |
|---|---|---|---|---|---|---|
| The perianth tube represents (%) of perianth length | (10–)20–36% | (15–)25–36(–40)% | 20–36(–40)% | 20–36(–40)% | 25–45(–50)% | 40–58% |
| Outer 3 tepals | laterally overlap--ping; oblong, cucullate, green with broad pink, purple, red or white borders; veins dendriticly branched, strongly thickened | laterally overlapping; obovate, flat or outcurved, green with very broad white (sometimes pink) margins; veins dendriticly branched, moderately to strongly tickened | laterally overlapping; cucullate, oblong; the base with a poach like protrusion; green with narrow, usually white borders; veins dendriticly branched, moderately to strongly thickened | not overlapping, oblong; ± cucullate; green with usually pink borders; veins dendriticly branched, strongly tickened | not overlapping to slightly so; oblong, ± cucullate to flat; green with usually pink borders; veins dendriticly branched; moderately to strongly thickened | not overlapping; oblong; obscurely cucullate to flat; green with white margins which may be reddish-brown in the innermost part; veins unbranched, not thickened |
| **ACHENE;** Size | (2.2–)2.4–3.7 mm | (2.4–)2.7–4 mm | (1.8–)2–2.8 (–3) mm | (1.6–)2–2.6 (3) mm | (1.6–)1.8–2.8(–3) mm | (1.6–)1.8–2.8 mm |
| Morphology | enclosed in the perianth or only the tip visible; dark-brown, with 3 subequal, concave, coarsely striate-papillose faces; apex straight | enclosed in the perianth dark-brown, with 3 subequal, concave, coarsely striate-papillose faces; apex straight | usually enclosed; dark-brown to light-brown, with 3 subequal, concave to flat faces; coarsely striate-papillose to obscurely striate papillose; apex straight, sometimes slightly beaked | usually exerted (achene edges are visible); dark-brown; with 3 subequal, concave to flat and coarsely striate-papillose faces; sometimes one face is narrower; apex straight | usually exerted (achene edges are visible); dark-brown; often with one face narrower; faces concave to flat; coarsely straite-papillose faces, (rarely only roughened); apex straight or a little bent toward the narrow face | usually exerted; dark or light-brown; with one face narrower or sometimes biconvex; faces flat, almost smooth to coursely striate-papillose; apex straight or a little bent toward the narrow face |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Chromosome numbers** | 2n = 40, 60 | 2n = 40 | 2n=60 | 2n = 60 | 2n = 40, 60 | 2n = 40, 60 |
| **Intergrades with:** | ssp. *neglectum*, ssp. *buxiforme*, ssp. *boreale* | ssp. *aviculare* ssp. *buxiforme?* | ssp. *aviculare*, ssp. *boreale?* | ssp. *neglectum*, ssp. *depressum* | ssp. *rurivagum*, ssp. *depressum* | ssp. *rurivagum*, ssp. *neglectum*, ssp. *buxiforme*? |
| **Origin** | Eurasia | Northwestern Europe, Greenland | North America | Europe | Eurasia | Europe |
| **Distribution** | frequent across all of North America | Greenland, rare in Labrador | frequent across all of North America | rare in North America (Costea & Tardif, in ed.) | across most of North America, but less frequent than ssp. *depressum* | common across all of North America |
| **Ecology** | weed in ruderal places and cultivated fields; more sensitive to drought and trampling than ssp. *depressum* | sea-shores in open sand, drift banks and rocky shores shores | weed in ruderal habitats or sometimes agrestal; nondrifting sands, borders of marshes and dunes | dry and sunny habitats; mostly ruderal growing in pavement cracks and gravel | growing in all types of ruderal and agrestal habitats | agrestal and ruderal in heavily trampled habitats; sometimes in turf or grazed grasslands |

example subsp. *aviculare* (= *P. aviculare* s. str.) from the homophyllous taxa: subsp. *depressum* (= *P. arenastrum*) and subsp. *neglectum* (= *P. neglectum*). It was stated that heterophyllous plants have cauline leaves which are more than three times as long as the branch leaves, while homophyllous plants have stem and branch leaves of about the same size (e.g. Wolf & McNeill 1986). The ratio between the lengths of middle stem and branch leaves (Table 1) shows that using the above definitions, some plants of subsp. *aviculare* may be considered homophyllous, while some of the subsp. *depressum* and subsp. *neglectum* may be characterized as heterophyllous. Heterophylly is not always a clear cut character and it can be efficiently used by taking into account the mentioned ratios (Table 1). In other words, keeping in mind that some taxa are "more heterophyllous" than others. Another potential source of error is the morphology of the tepals. Cucullate tepals are said to be distinctive for North American taxa such as subsp. *buxiforme*. In contrast, the non-native taxa (e.g. subsp. *aviculare*) are said to possess flat tepals (Mitchell & Dean 1978). This is not true as subsp. *aviculare*, subsp. *neglectum* and often subsp. *depressum* may also exhibit cucullate tepals in fruit (Table 1).

**2. Polygonum hudsonianum** (Wolf & McNeill) Hinds

Wolf and McNeill (1986) described this taxon as a subspecies of *P. caurianum*. Later, Hinds (1995) observed that subsp. *hudsonianum* was clearly differentiated from *P. caurianum* and he raised the former to specific rank. However, the author noted that the "separation of *P. fowleri* and *P. hudsonianum* is [...] more difficult" (Hinds 1995). Indeed, intermediate plants may occur between the two taxa, making their identification problematic at times. Therefore, taking into account that *P. caurianum* is distinct from both (see below), we propose the classification of *P. hudsonianum* as a subspecies of *P. fowleri*:

**Polygonum fowleri** Robinson subsp. **hudsonianum** (Wolf & McNeill) Costea & Tardif, comb. nov. BASIONYM: *Polygonum caurianum* Robinson subsp. *hudsonianum* Wolf & McNeill, Rhodora 88:469. 1986. *Polygonum hudsonianum* (Wolf & McNeill) Hinds, Novon 5:165. 1995. TYPE: CANADA. QUÉBEC: Fort George, 30 Aug 1950, *E. Lepage 12863* (HOLOTYPE: DAO 539717!; ISOTYPE: QFA!).

**3. Polygonum humifusum** Merk ex Koch

Hultén (1968) observed that *P. caurianum* Robinson might be "closely related or identical" to *P. humifusum* Merck ex Koch from Siberia and Kamtschatka. The BONAP list (1998) explicitly considered the latter name as a nomenclatural synonym of the former. However, it must be noted that *P. humifusum* is the correct binomial because it has priority. This species has a unique feature: the lower leaves are often opposite, and Tzvelev (1979) even separated it in a distinct subsection - *Humifusa*. The closest North American species is *P. fowleri*, which may rarely (especially subsp. *hudsonianum*) have a few leaves that are opposite. For differences, see Hinds (1995). The comparison of Russian and North

American specimens of *P. humifusum* revealed morphological differences, which together with the disjunct geographical distribution allow the recognition of two subspecies:

**Polygonum humifusum** Merk ex Koch, Linnaea 22:205. 1849.

**a.** subsp. **humifusum**
Stems and leaves green. Perianth 1.5–2.0 mm, with ± erect tepals, green with white margins, only in some flowers with pink margins. Achene 2.1–2.7 mm, ± rostrate, the apex exserted 0.9–1.3 mm. 2n = 20. (Tzvelev 1979). Siberia and Kamtschatka.

**b.** subsp. **caurianum** (Robinson) Costea & Tardif, comb. et stat. nov. BASIONYM: *Polygonum caurianum* Robinson Proc. Bost. Soc. Nat. Hist. 31:264.1904. TYPE: U.S.A. ALASKA: Nushagak, 59° N 158° W, Aug 1882, *C.L. McKay s.n.* (HOLOTYPE: GH 32603!).

Stems and leaves reddish or purplish tinged (if leaves are green, at least the margins are reddish or purplish). Perianth 1.5–2.3(–3) mm, with ± outcurved tepals, green or purple with the margins pink to purple. Achene 1.4–1.6(–2.2) mm, not or obscurely beaked, with the apex exserted 0.1–0.5 mm. Chromosome number unknown. NW Alaska, Yukon and NW Territories.

**4. Polygonum prolificum** (Small) B.L. Robinson

*Polygonum prolificum* was originally described by Small (1894) as a variety of *P. ramosissimum*, and later it was raised to species rank by Robinson (1902). Mitchell and Dean (1978) mentioned that the specimens of the two taxa "show too much intergradation to be separated with satisfaction" and we confirm their findings. The subspecific rank is proposed for *P. prolificum*.

**Polygonum ramossisimum** Michx. subsp. **prolificum** (Small) Costea & Tardif, comb. et stat. nov. BASIONYM: *Polygonum ramossisimum* Michx var. *prolificum* Small, Bull. Torrey Bot. Club 21:171. 1894. *Polygonum prolificum* (Small) Robinson, Rhodora 4:68. 1902. TYPE: U.S.A. NEBRASKA: Exeter, *J.H. Wibbe s.n.* (HOLOTYPE: NY 323808!).

*Polygonum prolificum* var. *autumnale* Brenckle, Phytologia 2:404. 1948
*Polygonum prolificum* var. *profusum* Brenckle, Phytologia 2:404. 1948.

For differences between the two taxa see Mitchell and Dean (1978) and Wolf and McNeill (1986). Subsp. *prolificum* is less variable and less common than subsp. *ramossisimum*, growing mostly in wet, saline places, which are scattered across all of North America.

**5. Polygonum texense** M.C. Johnston

Recently, *P. texense* has been considered a synonym of *P. striatulum* (BONAP 1998; Hatch et al. 2002). Although the morphology of the flowers and fruits is very similar, the two perennial taxa are distinct on the basis of their leaf morphology and their different phenology and ecology. The varietal rank is proposed here for *P. texense*:

**Polygonum striatulum** Robinson var. **texense** (M.C. Johnston) Costea & Tardif, comb. et stat. nov. BASIONYM: *Polygonum texense* M.C. Johnston, Southw. Naturalist 14:257. 1969. TYPE: U.S.A. TEXAS, *J. Scudday s.n.* (HOLOTYPE: LL.; ISOTYPE: LL!)

For morphological differences between var. *striatulum* and var. *texense* see Correll and Johnston (1970). Plants of var. *striatulum* grow in eastern and southeastern Texas, while plants of var. *texense* occur in central-western Texas and southeastern New Mexico.

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