Five New Subspecies of *Braya* (Brassicaceae) from Canada

James G. Harris
Biology Department, Utah Valley State College, 800 West University Parkway, Orem, Utah 84058, U.S.A. harrisji@uvsc.edu

Abstract. Five new Canadian subspecies of *Braya* are described and illustrated, three within *B. humilis* (C. A. Meyer) B. L. Robinson (subsp. *ellesmerensis* J. G. Harris, subsp. *maccallae* J. G. Harris, and subsp. *porsildii* J. G. Harris), one within *B. glabella* Richardson (subsp. *prostrata* J. G. Harris), and one within *B. thorild-wulffii* Ostenfeld (subsp. *glabrata* J. G. Harris). Keys to the North American subspecies of *B. humilis*, *B. glabella*, and *B. thorild-wulffii* are provided. Brief comments about the possible phylogenetic and phytogeographic significance of the subspecies of *B. humilis* are presented.

Résumé. Cinq nouvelles sous-espèces canadiennes de *Braya* sont décrites et illustrées, trois dans *B. humilis* (C. A. Meyer) B. L. Robinson (subsp. *ellesmerensis* J. G. Harris, subsp. *maccallae* J. G. Harris, et subsp. *porsildii* J. G. Harris), une dans *B. glabella* Richardson (subsp. *prostrata* J. G. Harris), et une dans *B. thorild-wulffii* Ostenfeld (subsp. *glabrata* J. G. Harris). Des clés aux sous-espèces de l'Amérique du Nord de *B. humilis*, *B. glabella*, et *B. thorild-wulffii*, sont données. Des commentaires brèves concernant la signification phylogénétique et phytogéographique possibles de la sous-espèce *B. humilis* sont présentés.

Key words: Brassicaceae, *Braya*, Canada, IUCN Conservation Status, *Neotorularia*, North America, *Platypetalum*, *Sisymbrium*, *Torularia*.

Specific and infraspecific classification in the polymorphic and taxonomically difficult genus *Braya* Sternberg & Hoppe (Brassicaceae, Sisymbrieae) is fraught with peril. Isolated populations often appear initially to be sufficiently distinct to warrant taxonomic recognition, and this has led to a long list of specific, subspecific, and varietal epithets in the genus (tables 1 & 2; Harris, 1985). Too often, however, most of these epithets are difficult or impossible to apply in practice. When the full range of morphological variation is examined, the majority of these proposed species and infraspecific taxa coalesce into a bewildering array of overlapping forms. As a result, most recent taxonomic treatments of *Braya* tend to be quite conservative, some avoiding infraspecific designations altogether (e.g., Rollins, 1993).

While a conservative taxonomic approach in *Braya* is probably appropriate and consistent with molecular-based phylogenetic studies (Warwick et al., 2004), completely ignoring infraspecific variation in the genus seems counterproductive. Some *Braya* species can be reliably subdivided into distinctive elements that may be biologically and phylogenetically significant. Subsuming these elements into an overly broad classification scheme only obscures phylogenetic relationships in *Braya*.

In anticipation of a forthcoming treatment of the Brassicaceae for the *Flora of North America* project, this paper provides epithets for five previously unrecognized Canadian subspecies of *Braya*, three within *B. humilis* (C. A. Meyer) B. L. Robinson, and one each within *B. glabella* Richardson and *B. thorild-wulffii* Ostenfeld. All of the subspecies described here were informally proposed for infraspecific recognition as varieties of *Braya* (Harris, 1985), but never validly published. I have chosen the subspecies rank here instead in order to bring the nomenclature in *Braya* into conformity with treatments of other genera of the Brassicaceae in an upcoming volume of the *Flora of North America*.

1. Braya humilis (C. A. Meyer) B. L. Robinson, in A. Gray & S. Watson, Syn. Fl. N. Amer. I. 1: 141. 1895. Basionym: *Sisymbrium humile* C. A. Meyer, in Ledeb., Icon. Pl. 2: 16. 1830. *Torularia humilis* (C. A. Meyer) O. E. Schulz, Repert. Spec. Nov. Regni. Veg. Beih. 12: 390. 1922. *Neotorularia humilis* (C. A. Meyer) Hedge & J. Léonard, Bull. Jard. Bot. Belg. 56: 394. 1986. TYPE: Russia. Altai: in subsalsis siccis ad fluvios Kenlyk, Kan, Jebagan; ad fluvium Tchuja, Jul. 1826, *A. Bunge 1033* (holotype, LE).

Braya humilis is an extremely polymorphic species of wide distribution in arctic, subarctic, and montane regions of the Northern Hemisphere (Abbe, 1948; Hultén, 1971; Böcher, 1973; Appel & Al-Shehbaz, 2003). Morphological variation in *Braya* is apparently caused and maintained by polyploidy and inbreeding of isolated populations. North American populations

of *B. humilis* are tetraploid ($2n = 28$), hexaploid ($2n = 42$), octoploid ($2n = 56$), and decaploid ($2n = 70$) (Mulligan, 1965; Harris, 1985; Warwick et al., 2004). In some cases morphological form is correlated with ploidy level. Hexaploid populations, for example, tend to show more morphological variation than populations of other ploidy levels (Mulligan, 1965), ranging from small, delicate individuals to large, robust plants. In most cases, however, morphological form does not correlate with ploidy level (Harris, 1985).

Attempts to recognize seemingly distinctive forms of *Braya humilis*, most from discontinuous populations from eastern North America, at the species (Rydberg, 1907; Fernald, 1918; Sørensen, 1954), subspecies (Rollins, 1953; Böcher, 1950, 1956; Hultén, 1968), and variety (Fernald, 1918, 1937; Böcher, 1956; Boivin, 1968, 1969) ranks have generally proved difficult. Geographically separated populations often look quite different, but they generally grade into one another through a series of morphological intermediates. This is particularly true in western North America, where *B. humilis* populations tend to be more continuous.

Most of the morphological variation in *Braya humilis* in North America is best treated within the type subspecies. Three forms, however, are rather striking, and they are easily distinguished from other *B. humilis* populations. They are recognized here as three new subspecies.

All three new subspecies are restricted to locations in and near regions believed to have remained ice-free during the Pleistocene (Prest, 1969; Cody, 1971; Packer, 1971; Packer & Vitt, 1974; Wolf et al., 1979). Plants surviving in these glacial refugia may have played a role in the recolonization by *Braya humilis* of extensive portions of northern North America in postglacial times. *Braya humilis* subsp. *porsildii* and *B. humilis* subsp. *maccallae* may be particularly significant in this regard. Both are almost completely allogamous (Harris, 1985), in contrast to subspecies *humilis*, which is autogamous, both have flowers almost twice as large as those in other *B. humilis* subspecies, and both show reduced fruit maturation and seed set. In addition, both are tetraploid, the lowest ploidy level known in *B. humilis* (most populations of *B. humilis* subsp. *humilis* are hexaploid or octoploid, but a few decaploid and tetraploid populations are known). This pattern of allogamy in tetraploids with large flowers, reduced seed set, reduced fruit maturation, and narrow distribution (*B. humilis* subsp. *maccallae* and subsp. *porsildii*) and autogamy in higher polyploids with smaller flowers, normal seed set, consistent fruit development, and wider distribution (*B. humilis* subsp. *humilis*) follows closely the list of characters outlined by Ornduff (1969) as common in allogamous and autogamous plants. Perhaps these allogamous tetraploids of restricted distribution gave rise to some of the more widely distributed autogamous *B. humilis* populations of higher ploidy levels.

KEY TO THE NORTH AMERICAN SUBSPECIES OF *BRAYA HUMILIS*

1a. Siliques 1.2–1.8 mm wide, not torulose; stems simple, prostrate in fruit. . . . . subsp. *ellesmerensis*
1b. Siliques 0.6–1.2(–1.3) mm wide, usually somewhat torulose; stems simple or branched, ascending to erect in fruit.
  2a. Petals usually less than 5 mm long; flowers usually developing fertile fruits; leaves often dentate or pinnatifid . . . . . subsp. *humilis*
  2b. Petals usually more than 5 mm long; flowers often developing abortive fruits; leaves entire, seldom dentate or pinnatifid.
    3a. Leaves and stems glabrescent to moderately pubescent . . . . . .subsp. *maccallae*
    3b. Leaves and stems densely pubescent. . . . . .subsp. *porsildii*

1. Braya humilis subsp. **ellesmerensis** J. G. Harris, subsp. nov. TYPE: Canada. Nunavut: Ellesmere Island, Hazen Camp, level delta plain 1 1/2 mi. WSW of Camp, 28 July 1962, *D. B. O. Savile 4763* (holotype, DAO). Figure 1.

Brayae humili subsp. *humili* similis, sed caulibus prostratis et siliquis latioribus differt.

Perennial herbs 3–16 cm tall; stems simple, ascending in flower, becoming prostrate in fruit, purple or purple-tinged, moderately pubescent with biforked and simple hairs. Leaves basal and cauline, oblanceolate, petiolate or merely cuneate at the base, pinnatifid to entire, 7–45 × 1.5–6 mm, moderately pubescent with simple and biforked hairs, green to purple-tinged. Racemes 5- to 35-flowered, condensed in flower but elongating in fruit. Sepals (1.9–)2.5–4.2 × (1.1–)1.3–2.2 mm, pubescent with long simple and biforked hairs, green or purple-tinged; petals white or purple-tinged, distinctly and abruptly divided into a claw and broad blade, (3–)4–5.6 × (1.3–)2–3.3 (–3.8) mm. Siliques straight or curved, not at all or only weakly torulose, 9–25 × (1–)1.2–1.8(–2) mm; valves densely to moderately pubescent with simple and biforked hairs; septum often fenestrate with circular perforations at regular intervals longitudinally or with a narrow elliptical longitudinal split at the base, or both; style 0.3–1 mm long, stout; stigma capitate and broadly bilobed or less often not capitate and only weakly bilobed. Seeds 0.9–1.1 mm long, 0.5–0.7 mm wide. $2n = 42$, from the type collection (Mulligan, 1965).

Braya humilis subsp. *ellesmerensis* differs from other *B. humilis* subspecies in the broad siliques (to 1.8 mm vs. only to 1.3 mm), prostrate fruiting stems,

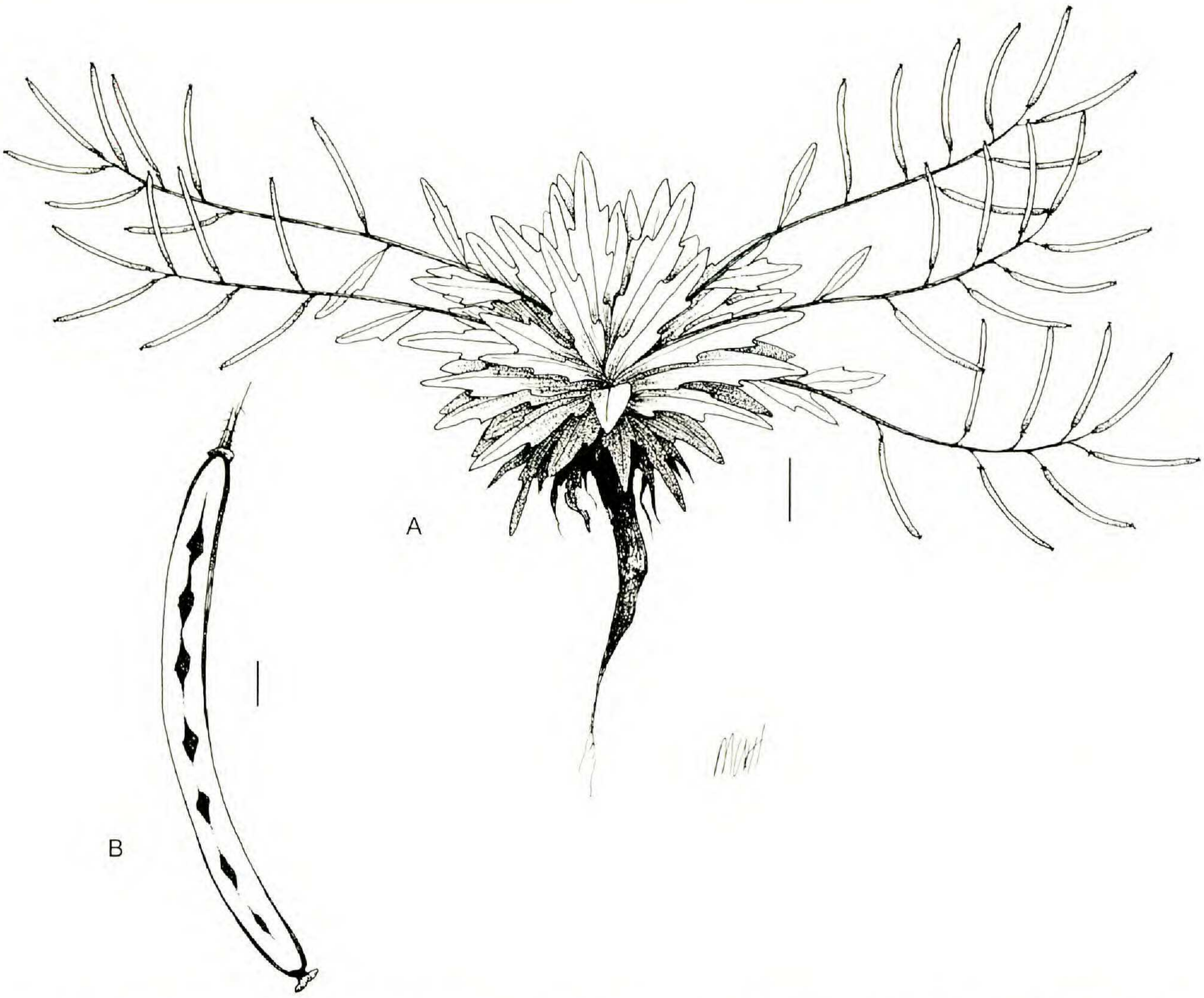

Figure 1. *Braya humilis* (C. A. Meyer) B. L. Robinson subsp. *ellesmerensis* J. G. Harris. —A. Plant. —B. Silique with valve removed. Scale: A = 1 cm; B = 1 mm. Drawn from the holotype (*D. B. O. Savile 4763*, DAO).

and fenestrate silique septae (the septae in other *B. humilis* subspecies lack fenestrations). In addition, the plants tend to be unusually robust compared to high Arctic representatives of subspecies *humilis*, with larger and more numerous leaves and stems. This taxon is endemic to sand, clay, and gravel slopes and plains of northern Ellesmere Island in the Canadian Arctic Archipelago. Due to its limited distribution, it should be considered for IUCN Conservation Status.

Paratypes. CANADA. **Nunavut, Ellesmere Island:** Fosheim Peninsula, *P. F. Bruggemann 831* (DAO); Hazen Camp, 3/4 mi. N of Camp, *D. B. O. Savile 4411* (DAO); head of Tanquary Fjord, *G. R. Brassard 1338, 1453* (CAN).

2. Braya humilis subsp. **maccallae** J. G. Harris, subsp. nov. TYPE: Canada. British Columbia: Yoho Nat. Park, flats of Kicking Horse River, opp. Mt. Stephen & E of Field, 24 June 1943, *W. C. McCalla 7539* (holotype, ALTA). Figure 2.

Differt a *Braya humili* subsp. *ellesmerensi* et subsp. *humili* petalis grandioribus et siliquis saepe abortivis, differt a *Braya humili* subsp. *porsildii* caulibus et foliis glabriusculis aut tantum modice pubescentibus.

Perennial herbs 4–23 cm tall; stems simple or sometimes branched, ascending to erect, moderately pubescent with biforked and simple hairs. Leaves basal and cauline, the basal leaves in a dense rosette, oblanceolate, rounded or narrowly obtuse, sessile with a cuneate base to distinctly petiolate, entire or occasionally sinuate-dentate, 5–50 × 1–7 mm, glabrescent to moderately pubescent with biforked and simple hairs, the cauline leaves often arising from near the base of the stem and much reduced. Racemes condensed in flower but elongating in fruit. Sepals 2.3–3.6 × 1.2–1.8(–2) mm, sparsely to moderately pubescent with long biforked and simple hairs, green to slightly purple-tinged; petals white or the claw occasionally purple-tinged, usually distinctly and abruptly divided into a claw and broad blade, (4.4–)4.9–6.7(–7.2) × (2.1–)2.3–4(–4.2) mm. Siliques more or less torulose, often aborted and undeveloped, 9–24 × 0.7–1.2 mm; valves moderately to densely pubescent with biforked and simple hairs; style (0.4–)0.7–1.3(–1.5) mm long, fairly stout; stigma not at all capitate to moderately capitate, entire to bilobed. Seeds 0.9–1.3 mm long, 0.45–0.65 mm wide, $n = 14$, *R. L. Taylor & D. H. Ferguson 2427* (Mulligan, 1965);

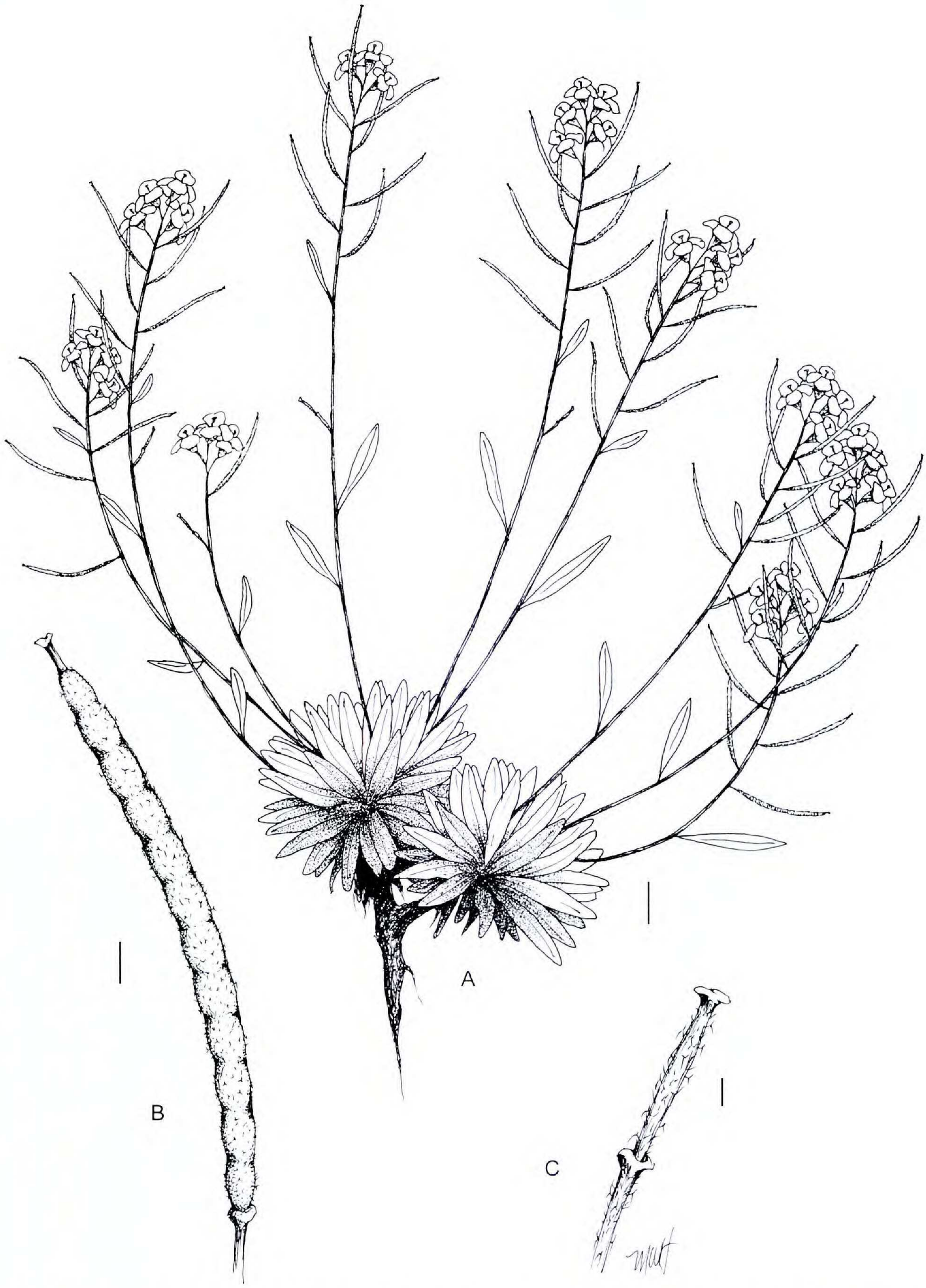

Figure 2. *Braya humilis* (C. A. Meyer) B. L. Robinson subsp. *maccallae* J. G. Harris. —A. Plant. —B. Silique. —C. Aborted silique. Scale: A = 1 cm; B, C = 1 mm. Drawn from the holotype (*W. C. McCalla 7539*, ALTA).

$2n = 28$, *J. G. Harris 1629* (ALTA), *J. G. Harris 1634* (ALTA).

Braya humilis subsp. *maccallae* is restricted to the Rocky Mountains of southern Alberta and British Columbia, where it is found on sandy, gravelly riverbanks and flood plains, and occasionally on glacial moraines. Its limited distribution indicates that it may be a candidate for IUCN Conservation Status. This subspecies differs from *B. humilis* subsp. *humilis* and subsp. *ellesmerensis* in its larger petals (up to 6.7 × 4 mm vs. only to 5.6 × 3.3 mm) and in its abortive siliques and from *B. humilis* subsp. *porsildii* in its glabrous to glabrescent leaves and stems.

Bernard Boivin annotated the type specimen in 1971 as "*Braya humilis* (C. A. Meyer) Rob. var. *McCallae* var. n." but the name was never published. The name honors W. C. McCalla, collector of several representative specimens of the subspecies, including the type specimen. The spelling of the epithet, "maccallae," is to be preserved. In addition to perhaps providing better pronunciation guidance in a word lacking capitalization, the spelling also follows Recommendation 60C.4(a) of the *International Code of Botanical Nomenclature*, which states that the Scottish patronymic prefix "Mc" "should be spelled 'mac' and united with the rest of the name."

Paratypes. CANADA. **Alberta:** Banff Nat. Park, flats at jct. of N Fork & W Br., Saskatchewan River, *S. Brown 1004* (GH, PH), *1006* (PH); on bank below the L. Louise–Jasper Rd., mi. 50, *W. C. McCalla 7076* (ALTA); Jasper Nat. Park, Sunwapta River, ca. mi. 50, *E. H. Moss 4852* (CAN); Sunwapta River nr. Beauty Ck., 23 June 1976, *I. Corns s.n.* (DAO); along Sunwapta River betw. Jasper & Banff, *A. Löve & D. Löve 6629* (DAO); 10 mi. NW of Columbia Glacier, *T. Mosquin & L. Mosquin 4691* (DAO); below Morro Peak along Athabaska River, *J. A. Calder & K. W. Spicer 33838* (DAO). **British Columbia:** Yoho Nat. Park, Kicking Horse River, ca. 2 km above Field, *J. G. Harris 1634* (ALTA, UVSC); sandy flats of Kicking Horse River opp. Mt. Stephen & E of Field, *W. C. McCalla 9566* (ALTA); on old gravel bar in Kicking Horse River, 3 mi. E of W Yoho Nat. Park gate, *R. L. Taylor & D. H. Ferguson 2427* (DAO); near Mt. Stephen Bung. Camp, *W. C. McCalla 7009* (ALTA); alluvial plain at head of Emerald Lake, *J. G. Harris 1629* (ALTA, UVSC), *W. C. McCalla 7452, 7030* (ALTA); Emerald Lake, *S. Brown 328* (PH), *J. Macoun 16* (PH); Kootenay Nat. Park, Lake McArthur, *F. K. Butters & E. W. D. Holway 153* (GH).

3. Braya humilis subsp. **porsildii** J. G. Harris, subsp. nov. TYPE: Canada. Alberta: Jasper Nat. Park, lateral moraines of Athabaska Glacier, 28 July 1946, *A. E. Porsild & A. J. Breitung 16335* (holotype, CAN). Figure 3.

Brayae humili subsp. *maccallae* affinis, differt caulibus et foliis dense pubescentibus.

Perennial herbs 3–17(–25) cm tall; stems simple or occasionally branched, ascending to erect or rarely decumbent, densely pubescent with biforked and simple hairs. Leaves basal and cauline, the basal leaves in a dense rosette, oblanceolate, rounded or narrowly obtuse, distinctly petiolate or merely cuneate at the base, usually entire but at times weakly sinuate-dentate, 3–30 × 1–5 mm, densely pubescent with biforked and simple hairs. Racemes condensed in flower but elongating in fruit. Sepals (2–)2.3–3.7 × (1.1–)1.3–1.8 mm, pubescent with biforked and simple hairs; petals white, distinctly and abruptly divided into a claw and broad blade, 4.4–6.9 × (1.9–)2.3–4.2 mm. Siliques ± torulose, often aborted and undeveloped, (8–)9–25 × 0.8–1.2 mm; valves densely pubescent with biforked and simple hairs; style 0.7–1.3(–1.5) mm long, fairly broad; stigma not at all capitate to moderately capitate, entire to bilobed. Seeds 1–1.3 mm long, 0.45–0.68 mm wide. $2n = 28$, *J. G. Harris 1553* (ALTA), *J. G. Harris 1639* (ALTA).

Braya humilis subsp. *porsildii* grows on calcareous gravels and soils on alpine scree slopes, glacial moraines, and gravelbars from the Rocky Mountains of southern Alberta and British Columbia north to about 65 degrees north latitude in the Mackenzie Mountains of the Northwest Territories of Canada. It differs markedly from *B. humilis* subsp. *humilis* and subsp. *ellesmerensis* in its larger flowers (up to 6.9 × 4.2 mm vs. only to 5.6 × 3.3 mm) and in its abortive siliques and from *B. humilis* subsp. *maccallae* in its densely pubescent leaves and stems.

This taxon was first recognized as unique by A. E. Porsild, who informally proposed the name *Braya vestita* on several herbarium sheets, including the type specimen. This name, however, was never published and the epithet was subsequently applied by Hultén (1968) to his combination *Braya bartlettiana* Jordal var. *vestita* Hultén. I have named the subspecies in honor of Porsild in recognition of his innumerable contributions to our understanding of northern plants.

Paratypes. CANADA. **Alberta:** Jasper Nat. Park, *H. M. Laing 291* (CAN); vic. of Athabasca Glacier, *A. E. Porsild & A. J. Breitung 14495* (CAN); Columbia Icefield, *H. J. Scoggan 16439* (CAN), 9 July 1975, *S. Kojima s.n.* (DAO); shoulder of Athabasca Mt., *E. H. Moss 4928* (ALTA, CAN); Banff Nat. Park, N Saskatchewan River at Saskatchewan Glacier, *B. Boivin 5083* (DAO); ridge betw. Mt. Athabaska & Saskatchewan Glacier, *A. E. Porsild & A. J. Breitung 14586, 14554* (CAN); Lake Louise, near Victoria Glacier, *A. E. Porsild & A. J. Breitung 15704* (CAN), *J. G. Harris 1639* (ALTA, UVSC); Nigel Pass, 28 July 1976, *I. Corns s.n.* (DAO); alpine slopes of Mt. Saskatchewan, *A. E. Porsild & A. J. Breitung 16060* (CAN). **British Columbia:** vic. of Summit Pass, Rocky Mts., *H. M. Raup & D. S. Correll 10564* (CAN); Alaska Hwy., N Tetsa River E of Summit at mi. 380, *J. A. Calder & I. Kukkonen 27395* (DAO); Stone Mtn. Prov. Park, Summit Lake, *J. G. Harris 1553* (ALTA, UVSC); just SW of Good Hope Road at mi. 66 on Cassiar Road, *J. A. Calder & J. M. Gillett 24769* (DAO); N of Muncho Lake at mi. 474 Alaska Hwy., *J. A. Calder & J. M. Gillett 25544* (DAO); along Toad River at mi. 432 Alaska Hwy., *J. A. Calder & J. M. Gillett 25343* (DAO); Graham River, *Mrs. J. N. Henry 501* (PH); below Mt. St. George at mi. 393 Alaska Hwy., *J. A. Calder & J. M. Gillett 26575* (DAO); Prospector's Valley, *F. K. Butters & E. W. D. Holway 139* (GH). **Northwest Territories:** Mackenzie Mts., *E. Kvale & K. Haggard 227, 235* (DAO), *E. R. Rowlands 9* (DAO), *E. Kvale & K. Haggard 14, 62* (DAO); Nahanni Nat. Park, *S. Talbot T6077-16* (DAO); S Nahanni River, Deadman Valley, *H. M. Kershaw 99* (DAO); Liard River, betw. Nahanni Butte and Simpson, *C. H. Crickmay 51* (CAN); Carcajou Range, Carcajou Lake, *W. J. Cody & F. M. Brigham 20540, 20954* (DAO); Carcajou Lake, Little Keele River, *P. M. Youngman & G. Tessier 725* (CAN).

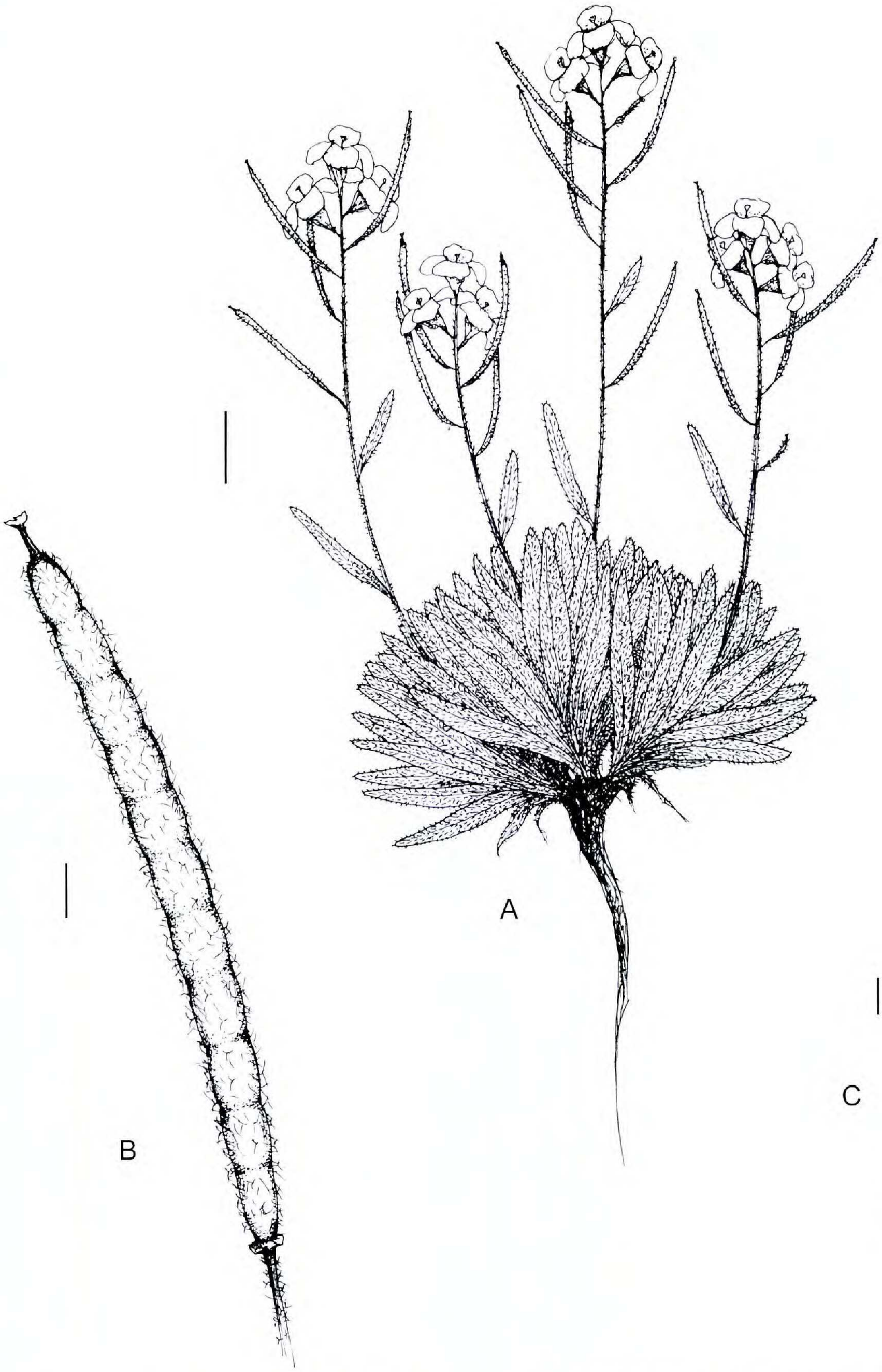

Figure 3. *Braya humilis* (C. A. Meyer) B. L. Robinson subsp. *porsildii* J. G. Harris. —A. Plant. —B. Silique. —C. Aborted silique. —Scale: A = 1 cm; B, C = 1 mm. Drawn from the holotype (*A. E. Porsild & A. J. Breitung 16335*, CAN).

II. Braya glabella Richardson, Bot. App., Franklin's Narr. Journey Polar Sea, ed. 1, p. 743. 1823. *Braya alpina* var. *glabella* (Richardson) S. Watson, Bibliogr. Index N. Amer. Bot. 51. 1878. TYPE: Canada. Nunavut: Copper Mountains, 1820, *J. Richardson s.n.* (holotype, BM; isotype, GH).

Braya glabella Richardson subsp. *purpurascens* (R. Brown) W. J. Cody, Canad. Field-Naturalist 108: 93. 1994. Basionym: *Platypetalum purpurascens* R. Brown, Chloris Melvilliana p. 9 & 50. 1823. *Braya purpurascens* (R. Brown) Bunge ex Ledebour, Flor. Ross. 1: 195. 1841. 1924. TYPE: Canada. Canadian Arctic Archipelago, Melville Island, 1820, *J. Ross s.n.* (holotype, BM).

Like *Braya humilis*, *B. glabella* is highly polymorphic, making the recognition of reliably distinguishable infraspecific entities difficult. *Braya*

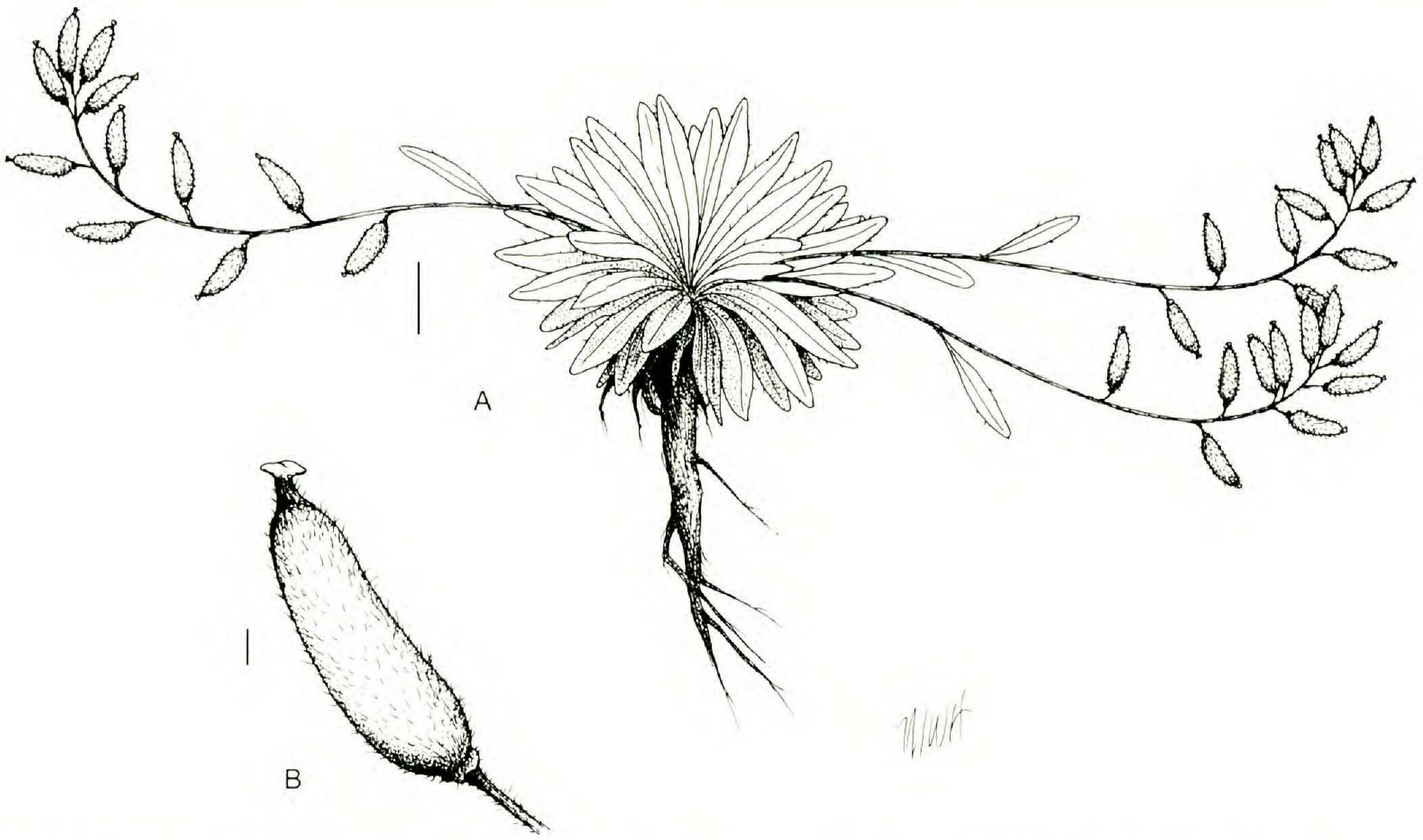

Figure 4. *Braya glabella* Richardson subsp. *prostrata* J. G. Harris. —A. Plant. —B. Silicle. Scale: A = 1 cm; B = 1 mm. Drawn from the holotype (*D. B. O. Savile 4764A*, DAO).

glabella subsp. *glabella* and *B. glabella* subsp. *purpurascens* (R. Brown) W. J. Cody were originally placed in different genera (Richardson, 1823; Brown, 1823), and subsequently they have often been recognized as separate species (Hooker, 1830; Torrey & Gray, 1838; Polunin, 1959; Welsh, 1974; Porsild & Cody, 1980). But even these seemingly well-differentiated taxa can be problematic and were not distinguished in ITS-based studies (Warwick et al., 2004). Populations from the high Arctic generally fall within the typical morphology of subspecies *purpurascens*, while populations from subarctic and montane regions usually have the morphology associated with subspecies *glabella*. In areas of overlap along the northern coast of continental North America and in the more southern portions of the Canadian Arctic Archipelago, however, it is not always possible to identify the two subspecies with certainty. Nonetheless, some populations of *B. glabella* from northern Ellesmere Island are sufficiently distinct from both subspecies *glabella* and *purpurascens* that they warrant taxonomic recognition as an additional subspecies.

Key to the North American Subspecies of *Braya glabella*

1a. Siliques oblong to narrowly oblong-lanceolate, 3.5–8.3 times longer than broad; racemes often loosely elongated in fruit . . . . . subsp. *glabella*

1b. Siliques ovate-elliptic to oblong-elliptic, rarely broadly oblong-lanceolate, 2.5–3.7 times longer than broad; racemes usually not loosely elongated in fruit, often compact.

2a. Stems ascending to erect; leaves usually somewhat fleshy, to 4 mm wide; fruits 5–10 mm; style 0.5–1.2 mm . . . subsp. *purpurascens*

2b. Stems decumbent to prostrate, occasionally weakly ascending; leaves not fleshy, to 6 mm wide; fruits 8–12 mm; style 0.8–1.8 mm . . . . . subsp. *prostrata*

1. Braya glabella subsp. **prostrata** J. G. Harris, subsp. nov. TYPE: Canada. Nunavut: Ellesmere Island, Hazen Camp, level delta plain 1 1/2 mi. WSW of Camp, 28 July 1962, *D. B. O. Savile 4764A* (holotype, DAO). Figure 4.

Differt a *Braya glabella* subsp. *glabella* et subsp. *purpurascenti* caulibus prostratis et foliis latioribus tenuioribus.

Perennial herbs 3.5–15 cm tall from a thick taproot, the caudex simple or branched; stems simple, decumbent to prostrate or weakly ascending, moderately to densely pubescent with long simple or at times biforked hairs. Leaves basal with an occasional single bractlike cauline leaf, the basal leaves usually broadly spatulate, not particularly fleshy, rounded or narrowly obtuse, entire, 9–45 × 1.5–6 mm, glabrescent with a few scattered long, simple or rarely biforked hairs mainly along the margins; leaf bases broadly expanded and often wider than the leaf blades, membranous. Racemes condensed in flower but elongating in fruit. Sepals 2.4–3.7(–4) × (1–)1.4–2 mm, glabrescent with a few scattered long, simple hairs; petals white to purple-tinged, (3–)3.5–4.7 × 1.6–3(–3.2) mm. Siliques oblong-elliptic to broadly

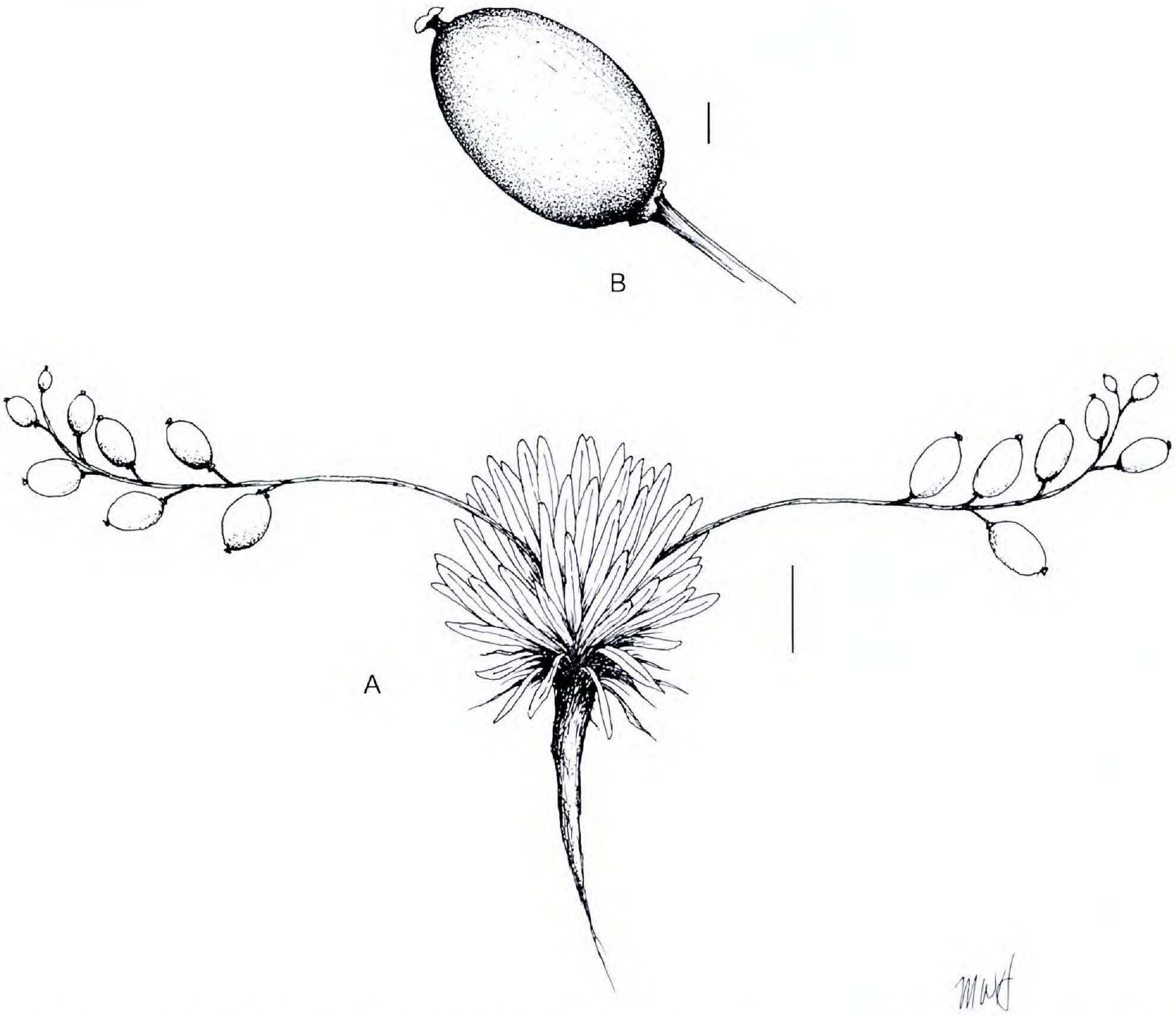

Figure 5. *Braya thorild-wulffii* Ostenfeld subsp. *glabrata* J. G. Harris. —A. Plant. —B. Silicle. Scale: A = 1 cm; B = 1 mm. Drawn from the holotype (*W. J. Maher & S. MacLean cat. no. 139*, CAN).

oblong-lanceolate, straight or curved, not torulose, (6.8–)8–12 × 2.5–3.6 mm; valves sparsely to moderately pubescent with stiff simple or occasionally biforked hairs; style 0.8–1.8 mm long, stout; stigma capitate to not at all capitate, bilobed to subentire. Seeds 1.4–1.7 mm long, 0.7–0.9 mm wide. $2n = 56$, from the type collection (Mulligan, 1965).

Braya glabella subsp. *prostrata* is distinguished from subspecies *glabella* by its non-fleshy and broader leaves (to 6 mm vs. to 4 mm), prostrate stems, and fruits 2.5–3.7 times longer than broad (vs. 3.5–8.3 times longer than broad). It is distinguished from subspecies *purpurascens* by its prostrate stems, non-fleshy and broader leaves (to 6 mm vs. to 4 mm), larger fruits (to 12 mm vs. to 10 mm), and longer styles (to 1.8 mm vs. to 1.2 mm). It is found on barren slopes and plains on northern Ellesmere Island in the Canadian Arctic Archipelago. The limited distribution of this taxon warrants its consideration for IUCN Conservation Status.

Paratypes. CANADA. **Nunavut, Ellesmere Island:** Fosheim Penin., Slidre Fjord, *S. D. MacDonald 297* (CAN); Fosheim Penin., *P. F. Bruggemann 835* (DAO); Eureka, *P. F. Bruggemann 818* (DAO).

III. Braya thorild-wulffii Ostenfeld, Meddel. Grønland 64, 176. 1923. *Braya purpurascens* (R. Brown) Bunge ex Ledebour subsp. *thorild-wulffii* (Ostenfeld) Hultén, Circum. Plants II. 18. 1970. *Braya purpurascens* var. *thorild-wulffii* (Ostenfeld) Boivin, Le Natur. Canadien 94: 646. 1967. *Braya pilosa* Hooker subsp. *thorild-wulffii* (Ostenfeld) Petrovsky, Flora Arct. URSS. 52. 1975. TYPE: Greenland. Gunnar Anderson Valley, 11 July 1917, *Th. Wulff s.n.* (holotype, C not seen; isotype, GH not seen).

Braya thorild-wulffii is a distinctive high arctic endemic of North America. Mature individuals are easily distinguished from *B. glabella* by the combination of decumbent habit, ovoid silicles, and extremely short styles (only to 0.75(1) mm vs. to 1.8(2) mm) and from *B. pilosa* Hooker by the much smaller flowers (only to 3.7 mm vs. to 6.6 mm), decumbent scapes, and short styles (only to 0.75(1) vs. to 2 mm). Throughout

most of its range in northern Greenland and the Canadian Arctic Archipelago, *B. thorild-wulffii* has densely pubescent inflorescences and fruits. Plants from the southern limits of its range on Banks and Victoria Islands in Northwest Territories and Nunavut, however, have glabrous to glabrescent inflorescences and fruits and are designated here as a new subspecies.

Key to the North American Subspecies of *Braya thorild-wulffii*

1a. Stems, pedicels, sepals, and silicles densely pubescent . . . . . subsp. *thorild-wulffii*
1b. Stems, pedicels, sepals, and silicles glabrous or glabrescent. . . . . .subsp. *glabrata*

1. Braya thorild-wulffii subsp. **glabrata** J. G. Harris, subsp. nov. TYPE: Canada. Northwest Territories: Banks Island, Bernard River, 6 Aug. 1963, *W. J. Maher & S. MacLean cat. no. 139* (holotype, CAN). Figure 5.

Brayae thorild-wulffii subsp. *thorild-wulffii* similis, sed inflorescentiis et siliculis glabris vel glabriusculis differt.

Perennial herbs (3–)5–9(–14) cm tall from a long taproot; stems 1 to many, simple, decumbent to prostrate or occasionally ascending, often bent or wavy, glabrous or glabrescent, green to purple-tinged. Leaves basal with an occasional single bractlike cauline leaf, the basal leaves spatulate to linear-spatulate, obtuse, entire, (5–)10–30(–40) × 1–4 mm, ciliate with long mostly simple hairs and often with a tuft of hairs at the apex, green to purple-tinged; leaf bases membranous and broadly expanded near point of attachment. Racemes of 3 to 10 flowers, condensed in flower but elongating in fruit, the pedicels spreading-erect, almost nonexistent in flower, 1.5–4 mm long in fruit. Sepals 2–3.5 × 1–2 mm, obtuse, glabrous to glabrescent, green to purple-tinged; petals scarcely longer than the sepals, 2–3.7 × 1–1.5 mm, not distinctly divided into a claw and blade, but tapering gradually from the narrow blade to the base, white to purplish white. Silicles ovoid to globose, not torulose, (4–)5–8(–10) × (2.5–)3–5 mm; valves glabrous to glabrescent; style short, from almost nonexistent to 0.75(1) mm long, stout; stigma broadly bilobed to entire. Seeds (1.1–)1.2–1.4(–1.5) mm long, (0.5–)0.7–0.8(–0.95) mm wide.

Braya thorild-wulffii subsp. *glabrata* is known from Banks and Victoria Islands in the Canadian Arctic Archipelago, where it grows on dry sands and clays.

A. E. Porsild informally proposed this taxon as a new variety on the type specimen. His handwritten annotation reads, "*Braya Thorild-wulffii* Ostenf. n. var. *glabrata* Porsild (sched.)," but the name was not published. I agree with Porsild that these allopatric, glabrous populations of *B. thorild-wulffii* warrant infraspecific recognition.

Paratypes. CANADA. **Northwest Territories:** Banks Island, *G. W. Scotter & S. C. Zoltai 31227* (DAO). **Nunavut:** Victoria Island, *W. D. Stretton 18* (DAO).

Acknowledgments. I thank Melinda Woolf Harris for her illustrations, David Madsen for his French translation of the abstract, and Li-Bing Zhang for help with the Latin diagnoses. I am indebted to Ihsan A. Al-Shehbaz for helpful suggestions and comments during the preparation of the paper, and to Victoria C. Hollowell, Vladislav V. Petrovsky, and Suzanne I. Warwick for their critical review of the manuscript.

Literature Cited

Abbe, E. C. 1948. *Braya* in boreal eastern America. Rhodora 50: 1–15.

Appel, O. & I. A. Al-Shehbaz. 2003. Cruciferae. Pp. 75–174 *in* K. Kubitzki (editor), Families and Genera of Vascular Plants, Vol. 5. Springer-Verlag, Berlin.

Böcher, T. W. 1950. Contributions to the flora and plant geography of West Greenland II. Meddel. Grønland 147, No. 7: 1–39.

———. 1956. Further studies in *Braya humilis* and allied species. Meddel. Grønland 124, No. 7: 1–29.

———. 1973. Interspecific hybridization in *Braya* (Cruciferae). Ann. Bot. Fenn. 10: 57–65.

Boivin, B. 1968. Flora of the prairie provinces. Phytologia 16: 219–339.

———. 1969. Flora of the prairie provinces. Phytologia 17: 58–292.

Brown, R. 1823. Chloris Melvilliana. W. Clowes, London.

Cody, W. J. 1971. A phytogeographical study of of the floras of the continental Northwest Territories and Yukon. Naturaliste Canad. 98: 145–158.

Fernald, M. L. 1918. Some North American representatives of *Braya humilis*. Rhodora 20: 201–203.

———. 1937. No title. Rhodora 39: 276.

Harris, J. G. 1985. A Revision of the Genus *Braya* (Cruciferae) in North America. Ph.D. thesis [unpublished]. University of Alberta, Edmonton.

Hooker, W. J. 1830. Flora Boreali-Americana, Vol. I. H. G. Bohn, London.

Hultén, E. 1968. Comments on the flora of Alaska and Yukon. Ark. Bot. 7: 1–47.

———. 1971. The Circumpolar Plants. II. Kungl. Svenska Vetensk.-Akad. Handl. Fjärde Ser. Band 13, No. 1. Almqvist & Wiksell, Stockholm.

Mulligan, G. A. 1965. Chromosome numbers of the family Cruciferae. II. Canad. J. Bot. 43: 657–668.

Ornduff, R. 1969. Reproductive biology in relation to systematics. Taxon 18: 121–133.

Packer, J. G. 1971. Endemism in the flora of western Canada. Naturaliste Canad. 98: 131–144.

——— & D. H. Vitt. 1974. Mountain Park: A plant refugium in the Canadian Rocky Mountains. Canad. J. Bot. 52: 1393–1409.

Polunin, N. 1959. Circumpolar Arctic Flora. Clarendon Press, Oxford.

Porsild, A. E. & W. J. Cody. 1980. Vascular Plants of Continental Northwest Territories, Canada. National Museum of Natural Sciences, National Museums of Canada, Ottawa.

Prest, V. K. 1969. Retreat of Wisconsin and Recent Ice in North America. Geological Survey of Canada, Dept. of Energy, Mines and Resources, Map 1257-A.

Richardson, J. 1823. *In* J. Franklin, Narrative of a Journey to the Shores of the Polar Sea in the Years 1819, 20, 21, and 22. Botanical Appendix. J. Murray, London.

Rollins, R. C. 1953. *Braya* in Colorado. Rhodora 55: 109–116.

———. 1993. The Cruciferae of Continental North America. Stanford Univ. Press, Stanford.

Rydberg, P. A. 1907. The genus *Pilosella* in North America. Torreya 7: 157–162.

Sørensen, T. 1954. New species of *Hierochloe*, *Calamagrostis*, and *Braya*. Meddel. Grønland 136, No. 8: 1–24.

Torrey, J. & A. Gray. 1838. A Flora of North America, Vol. I, Part I. G. & C. Carvill, New York.

Warwick, S. I., I. A. Al-Shehbaz, C. Sauder, J. G. Harris & M. Koch. 2004. Phylogeny of *Braya* and *Neotorularia* (Brassicaceae) based on nuclear ribosomal internal transcribed spacer and chloroplast *trn*L intron sequences. Canad. J. Bot. 82: 376–392.

Welsh, S. L. 1974. Anderson's Flora of Alaska and Adjacent Parts of Canada. Brigham Young Univ. Press, Provo, Utah.

Wolf, S. J., J. G. Packer & K. E. Denford. 1979. The taxonomy of *Minuartia rossii* (Caryophyllaceae). Canad. J. Bot. 57: 1673–1686.