A taxonomic revision of *Allium* (Alliaceae) in the Canadian prairie provinces

**Hyeok Jae Choi and J. Hugo Cota-Sánchez**

**Abstract:** The taxonomy, rarity, and conservation status of *Allium* L. is revised for the Canadian prairie provinces, based on analyses of herbarium specimens and fieldwork. Five species are recognized: *Allium schoenoprasum* L., *A. geyeri* S. Watson var. *tenerum* M.E. Jones, *A. textile* A. Nelson & J.F. Macbride, *A. cernuum* Roth, and *A. stellatum* Ker Gawler. Distribution maps and a key to species are provided, as well as complete descriptions of the species examined, including new illustrations, information on nomenclatural types, synonymies, and chromosomal and ecological data. A lectotype is designated for *A. geyeri* var. *tenerum*. In this study, *A. geyeri* var. *geyeri* reported from Alberta and Saskatchewan and ranked in these provinces as having rarity levels *S2* and *S1*, respectively, by the Nature Conservancy, is excluded from the Canadian flora and the rare list of these provinces because it was misidentified from a herbarium specimen of *A. textile*. *Allium tricoccum* Solander in W. Aiton is regarded as a non-native species to Manitoba. The rarity and conservation status of *Allium* in the Canadian prairie provinces is as follows: (i) *A. schoenoprasum*, listed as *S2* in Saskatchewan, is rare in Manitoba, although its rarity status has not been formally assessed in the province; (ii) *A. geyeri* var. *tenerum* is the rarest *Allium* taxon, with distribution restricted to the Waterton Lakes National Park areas of Alberta, and is currently listed as *S2*; and (iii) *A. cernuum* was re-evaluated and a rarity level of *S1S2* was recommended for the species in Saskatchewan, particularly in its southwestern distributional habitat.

**Key words:** *Allium*, Canada, conservation status, prairie provinces, rare species, taxonomy.


**Mots-clés :** *Allium*, Canada, statut de conservation, provinces des prairies, espèce rare, taxonomie.

**Introduction**

The genus *Allium* L. has been traditionally circumscribed in the tribe Allieae under the Liliaceae (Bentham and Hooker 1883; Lawrence 1951; Xu and Kamelin 2000), but recently this genus has been placed by various authors in its own family Alliaceae (Dahlgren et al. 1985; Takhtajan 1997; Rahn 1998; Friesen et al. 2000). The genus is characterized by the presence of bulbs enclosed in membranous (sometimes finely fibrous) tunicas, free or almost free tepals, and often a subgynobasic style (Friesen et al. 2006). Most taxa produce remarkable amounts of cystein sulphoxides,
causing the characteristic odour and taste of garlic, onion, and leek (Fritsch and Keusgen 2006).

With over 800 species, Allium is naturally distributed in the Northern hemisphere, mainly in seasonally dry regions (Friesen et al. 2006; Nguyen et al. 2008; Neshati and Fritsch 2009). The greatest diversity of Allium occurs in the Mediterranean basin and southwestern and central Asia, which is the primary centre of diversity, but a smaller secondary area of diversification is found in North America (Friesen et al. 2006; Nguyen et al. 2008). The North American centre of diversity is subdivided into two areas: one including the region of Texas, and the other the California Floristic Province (McNeal 1992; Nguyen et al. 2008). Despite the cultural, economic, nutritional, and health significance of Allium in human society, to date, its taxonomy remains complex, owing to the proliferation of synonyms and disagreement in taxonomic characters used in species boundaries. In fact, Allium's complex taxonomic history includes 1400 specific epithets, often from inadequate or incomplete material, which are currently under synonymy with existing species (Gregory et al. 1998). Nevertheless, a comprehensive generic monograph has not been compiled since that of Regel (1875).

It has been suggested that Allium has been around in the New World since at least the Tertiary Period (Raven and Axelrod 1978), and that approximately 1/6 of the world's Allium diversity, i.e., about 96 species, is found in North America north of Mexico, with 12 of those species known from Canada (McNeal 1992; McNeal and Jacobsen 2002). Among these 12 taxa, only one species, Allium schoenoprasum L., is widespread in the native floras of both the Old and New World (McNeal 1992; McNeal and Jacobsen 2002). Allium victorialis L. also occurs in both Eurasia and North America; however, its North American distribution is restricted to Attu Island, the westernmost island of the Aleutian archipelago (McNeal and Jacobsen 2002). Allium tricoccum Solander in W. Aiton, and A. victorialis, which share the same basic chromosome number (x = 8) with the majority of Old World species (McNeal 1992; McNeal and Jacobsen 2002).

Several criteria have been used in the classification of Allium species. For instance, the sexuality of the plants, structure and shape of the underground parts (including rhizome and bulb), anatomical features of root, leaf, scape, and ovary, as well as basic chromosome number, have been useful at the subgeneric and sectional levels (Fritsch 1992; Hanelt et al. 1992; Kruse 1992; McNeal 1992; Friesen et al. 2006; Gurushidze et al. 2008; Nguyen et al. 2008; Choi 2009). In addition, the shape and size of floral organs such as the perianth, filament, pistil, capsule, seed, and somatic chromosome number have provided diagnostic characters at the specific level (McNeal 1992; Choi et al. 2007; Ko et al. 2009), and scanning electron microscopy (SEM) has allowed the characterization of cell pattern and ornamentation of the bulb coat, leaf, and seed coat, improving the taxonomy of the genus Allium (Kruse 1992; McNeal 1992; Choi et al. 2004; Fritsch et al. 2006; Choi 2009).

Even with recent progress, the taxonomic understanding of Allium has been limited, in part due to the fact that New World species are poorly represented in herbaria (McNeal 1992; H.J. Choi, personal observation). The lack of well-preserved voucher specimens regarding the geographic range of the genus has led to the misinterpretation of the patterns of morphological variation in numerous taxa, with subsequent confusion about species boundaries and distribution. While extensive collecting has added valuable material to the American systematic collections, allowing the reappraisal of morphological characters used in Allium classification (McNeal 1992), most Canadian herbaria are less diverse but contain valuable historical specimens collected by various botanists from the 1950s to the 1980s (H.J. Choi and J.H. Cota-Sánchez, personal observation). The relatively narrow representation of Canadian Allium specimens in North American herbaria is in part related to the few systematic studies dealing with Canadian species. Systematic studies of Canadian Allium, excluding that of the Flora of North America (McNeal and Jacobsen 2002), are mainly focused either on the western (e.g., Chinnappa and Basappa 1986) or eastern region (e.g., Barnston 1859; Ownbey and Aase 1955) of the country, areas with relatively more history, interest, and expertise in taxonomy. The paucity of Allium taxonomic studies from the Canadian prairies provinces (CPP) is evident.

The Canadian Prairies is a region of Canada for which several natural definitions have been used. Most notably, the CPP comprise the interior plain regions, i.e., the provinces of Alberta, Saskatchewan, and Manitoba, and are an extension of the US Great Plains region. In the past, the prairie landscape was characterized by extensive grasslands, aspen parklands, and an abundance of wetland areas, all supporting a diverse array of native biota (Pasitschniak-Arts and Messier 1999). However, during the last few decades, large areas of prairie have been cleared and converted to cropland. As a result, the prairies now form the largest expansion of agricultural land and one of the most human-altered and fragmented landscapes in Canada (Acton et al. 1998; Pung 1999; Pasitschniak-Arts and Messier 1999).

In addition to hosting unique prairie ecosystem biodiversity, the CPP have numerous native plants, including six Allium species, namely Allium schoenoprasum, A. geyeri var. Watson var. geyeri, A. geyeri var. tenerum M.E. Jones, Allium textile A. Nelson & J.F. Macbride, Allium cernuum Roth, and Allium stellatum Ker Gawler (McNeal and Jacobsen 2002). Nonetheless, previous taxonomic views, e.g., Scoggan (1957), Moss (1959), McNeal and Jacobsen (2002), and Harms (2003), are inconsistent in the number of species recognized for the CPP (Table 1). Among these, A. geyeri var. geyeri and A. geyeri var. tenerum have been designated as rare species in Alberta (Kershaw et al. 2001). Similarly, A. geyeri var. geyeri, in addition to A. cernuum and A. schoenoprasum, are included in Saskatchewan's rare and endangered plant list (Harms 2003). Finally, A. tricoccum is considered a rare plant in Manitoba (Scoggan 1957; White and Johnson 1980); however, this species has not been collected since 1923 (White and Johnson 1980), and its distribution in Manitoba is questionable.

Earlier taxonomies of Allium in the CPP do not include a holistic treatment. Here, we address the systematics of Allium in the CPP, using, for the first time, a combination of quantitative and qualitative data based on macro- and mi-
cro-morphological characters from vegetative structures, flowers, and seeds, observed in herbarium specimens. The goals of this study are (i) to expand the current knowledge of morphology and distribution, (ii) to address taxonomic issues, clarify type identifications, and provide a taxonomic treatment with new descriptions and illustrations of the species, and (iii) to review the rarity and conservation status of Allium in the CPP. The limited research involving CPP species, and the lack of a Saskatchewan flora, in conjunction with relevant unresolved issues surrounding the taxonomy, phylogeny, and evolution of the genus Allium, justifies this investigation. In addition to providing an update of the provincial taxonomic treatments and the basis for a future national and global monograph and systematic study of Allium, this research contributes to the preservation of traditional taxonomic studies in an era of bioinformatic systems and electronic databases, and is in line with the preservation of the fundamentals of classification and its application in biodiversity and conservation biology studies.

Materials and methods

Our taxonomic revision is based on 716 herbarium specimens, including nine photographs of type specimens from the following herbaria: ALTA, DAO, LINN, MO, NY, SASK, and WIN. A list of the specimens investigated is included (Appendix A). The number of specimens studied per taxon depended on its representation among the collections investigated, the extent of its distributional area, its rarity, and the taxonomic difficulties involved. The number of accessions examined varied from 6 in Allium geyeri var. tenerum to 198 in A. textile. All the species, except A. geyeri var. tenerum, were also observed and field-collected by the authors in 2009. Material preserved in 70% ethanol (A. schoenoprasum, H.J. Choi-sk-4; A. textile, H.J. Choi-sk-2; A. cernuum, H.J. Choi-sk-10; A. stellatum, H.J. Choi-sk-12, H.J. Choi-sk-16) was used to observe and measure micromorphological characters, cross-sections in leaf and scape, and reproductive organs. Only dried specimens of A. geyeri var. tenerum were examined for this study because there was no live material available. The general description of the genus Allium is based on Choi (2009) as well as the observations indicated above.

General morphology

Characters from vegetative (rhizome, bulb, leaf, and scape) and reproductive (perianth, stamen, pistil, fruit, and seed) structures were analysed in each species (Table 2). Measurements were based on a minimum of 30 and 20 specimens (indicated by an asterisk in Appendix A) for vegetative organs and reproductive parts, respectively, from which the mean and standard deviations were calculated (Table 3). Specimens were observed and photographed using a TESSOVAR Photomacrogaphic Zoom System with Nikon D100. Segments from the middle third of the second leaf blade and scape were used for anatomical observation of the cross-section. Leaf and scape tissues fixed in 70% ethanol were free-hand sectioned, stained with Safranin O, washed with distilled water, and photographed. Line drawings were generated from photos and voucher specimens using Adobe Photoshop 7.01 (Adobe, www.adobe.com).
Table 2. Qualitative characters used in the taxonomy of *Allium* of the Canadian prairie provinces.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>A. schoenoprasum</em></th>
<th><em>A. geyeri var. tenerum</em></th>
<th><em>A. textile</em></th>
<th><em>A. cernuum</em></th>
<th><em>A. stellatum</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rhizome</strong></td>
<td>Condensed, oblique</td>
<td>Obsolete, erect</td>
<td>Obsolete, erect</td>
<td>Condensed, oblique</td>
<td>Condensed, oblique</td>
</tr>
<tr>
<td><strong>Bulb</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Cylindrically conical</td>
<td>Ovoid</td>
<td>Ovoid</td>
<td>Ovoid</td>
<td>Ovoid</td>
</tr>
<tr>
<td>Texture of tunica</td>
<td>Papery</td>
<td>Fibrous</td>
<td>Fibrous</td>
<td>Membranous</td>
<td>Membranous</td>
</tr>
<tr>
<td>Sculpture of tunica</td>
<td>Smooth</td>
<td>Reticulate</td>
<td>Reticulate</td>
<td>Smooth</td>
<td>Smooth</td>
</tr>
<tr>
<td>Colour of tunica</td>
<td>Dark brown</td>
<td>Gray to light brown</td>
<td>Gray to light brown</td>
<td>Gray to brown</td>
<td>Gray to brown</td>
</tr>
<tr>
<td><strong>Leaf blade</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apex</td>
<td>Acuminate</td>
<td>Observe</td>
<td>Acuminate to acute</td>
<td>Acuminate to obtuse</td>
<td>Acuminate to acute</td>
</tr>
<tr>
<td>Shape in cross-section</td>
<td>Terete</td>
<td>Flat to channelled</td>
<td>Channelled to semiterete</td>
<td>Nearly flat</td>
<td>Channelled to V-shaped</td>
</tr>
<tr>
<td>Pith in cross-section</td>
<td>Hollow</td>
<td>Solid</td>
<td>Solid</td>
<td>Solid</td>
<td>Solid</td>
</tr>
<tr>
<td>VB in cross-section</td>
<td>2-rowed</td>
<td>1-rowed</td>
<td>1-rowed</td>
<td>1-rowed</td>
<td>1-rowed</td>
</tr>
<tr>
<td><strong>Scape</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape in cross-section</td>
<td>Terete</td>
<td>Terete to minutely angular</td>
<td>Terete to angular</td>
<td>Terete to dully angular</td>
<td>Terete to dully angular</td>
</tr>
<tr>
<td>Pith in cross-section</td>
<td>Hollow</td>
<td>Solid</td>
<td>Solid</td>
<td>Solid</td>
<td>Solid</td>
</tr>
<tr>
<td>VB in cross-section</td>
<td>2-circular</td>
<td>2-circular</td>
<td>2-circular</td>
<td>2- to 3-circular</td>
<td>2- to 3-circular</td>
</tr>
<tr>
<td>Before anthesis</td>
<td>Erect</td>
<td>Curved</td>
<td>Curved</td>
<td>Recurved</td>
<td>Recurved</td>
</tr>
<tr>
<td>At flowering</td>
<td>Erect</td>
<td>Erect</td>
<td>Erect</td>
<td>Recurved</td>
<td>Erect</td>
</tr>
<tr>
<td><strong>Umbel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Subglobose</td>
<td>Hemispheric to globose</td>
<td>Subfascicled to hemispheric</td>
<td>Hemispheric to globose</td>
<td>Subfascicled to hemispheric</td>
</tr>
<tr>
<td>Bulblil</td>
<td>Absent</td>
<td>Developed</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>Perianth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Campanulate</td>
<td>Campanulate to urceolate</td>
<td>Campanulate to urceolate</td>
<td>Campanulate</td>
<td>Stellate</td>
</tr>
<tr>
<td>Colour</td>
<td>Reddish pink to deep lilac</td>
<td>Pink to white</td>
<td>White</td>
<td>Pink to white</td>
<td>Deep pink</td>
</tr>
<tr>
<td>Midvein</td>
<td>Reddish</td>
<td>Reddish</td>
<td>Reddish to greenish</td>
<td>Greenish</td>
<td>Reddish</td>
</tr>
<tr>
<td><strong>Inner tepal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Oblong-lancelate</td>
<td>Oblong to lancelate</td>
<td>Oblong</td>
<td>Elliptical-lanceolate</td>
<td>Acute</td>
</tr>
<tr>
<td>Apex</td>
<td>Acute</td>
<td>Acute to obtuse</td>
<td>Obtuse</td>
<td>Acute</td>
<td>Acute</td>
</tr>
<tr>
<td><strong>Outer tepal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Oblong-lancelate</td>
<td>Oblong to lancelate</td>
<td>Broadly ovate to lanceolate</td>
<td>Oval to orbicular</td>
<td>Elliptical</td>
</tr>
<tr>
<td>Apex</td>
<td>Acute</td>
<td>Acute to obtuse</td>
<td>Acute to obtuse</td>
<td>Subrounded</td>
<td>Acute</td>
</tr>
<tr>
<td><strong>Filament</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner filament</td>
<td>Non-exserted</td>
<td>Non-exserted</td>
<td>Non-exserted</td>
<td>Exserted</td>
<td>Non-exserted</td>
</tr>
<tr>
<td>Outer filament</td>
<td>Non-exserted</td>
<td>Non-exserted</td>
<td>Non-exserted</td>
<td>Exserted</td>
<td>Exserted</td>
</tr>
<tr>
<td><strong>Ovary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Ellipsoid</td>
<td>Subglobose</td>
<td>Subglobose</td>
<td>Subglobose</td>
<td>Subglobose</td>
</tr>
</tbody>
</table>
Microstructures

For the observation of micromorphological structures of leaf epidermis, stomatal apparatus, and seed testa, tissues were fixed in 70% ethanol, washed twice with 0.1 mol/L phosphate buffer (pH 6.8), refixed in 2.5% glutaraldehyde, dehydrated in an ethanol–acetone series, critical-point dried with Polaron E3000 Series II, mounted on stubs, and coated with gold in an Edwards S150B ion sputter coater. In all cases, at least five samples per taxon were analyzed, characterized, and photographed with a Philips 505 SEM (Fig. 1).

Map of geographic distribution

A map depicting the distributional range was prepared for each taxon based on herbarium specimens investigated as per Appendix A (Fig. 2). The maps were generated using a customized map development tool specially designed and based on the open-source code Google™ Maps API on-line development tool. The mapping software and data used can be found at the W.P. Fraser Herbarium (SASK) Web site (herbarium.usask.ca/MapDevelopment/mapsChoi.html). A data table of Allium localities for the CPP was generated to separate specimens by species and localities. Where specific latitude and longitude information was not provided in the voucher specimen, the coordinates were estimated based on the provided locality information using the Natural Resources Canada on-line Atlas of Canada reference maps (atlas.nrcan.gc.ca/site/english/maps/topo/map). Once the data table was linked to the mapping program, the maps were plotted. The Google™ map was imported into Adobe Photoshop 7.01 as a JPEG graphic, and the boundaries of the map were removed so that only the provinces of Alberta, Saskatchewan, and Manitoba remained. The source of ecological information is from data on specimen labels and the authors’ field observations.

Results and discussion

Taxonomic characters

Macromorphological characters

Our data indicate that several macromorphological characters, such as the shape and development of rhizome, texture and sculpture of the bulb’s outer tunica, shape and structure of leaf and scape in cross-section, number of leaves, the growing pattern of the scape, bulbil development, shape and size of various floral parts are useful diagnostic traits at the specific level. The qualitative and quantitative taxonomic characters of the Allium species in the CPP are summarized in Tables 2 and 3 along with a general description of their variability.

Microstructures of leaf epidermis

The leaf epidermal cells of the species investigated are usually rectangular to linear in shape, with straight anticlinal walls (Figs. 1A–1H; Choi et al. 2004). Allium schoenoprasum exhibits only cells of the linear type (Figs. 1A and 1E). Within species, the shape of the epidermal cells is similar on the adaxial and abaxial side of the leaf. The cuticular cell sculpture pattern is smooth (Figs. 1B, 1C, 1F, and 1G) or ridged (Figs. 1A, 1D, 1E, and 1H). Allium stellatum is distinguished by the prominent ridged walls (compared with
Table 3. Quantitative characters used in the taxonomy of *Allium* of the Canadian prairie provinces.

<table>
<thead>
<tr>
<th>Character</th>
<th>Measurement minimum (mean ± SD) and maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rhizome</strong> length (mm)</td>
<td>5.0 (7.03±1.64) 10.0</td>
</tr>
<tr>
<td><strong>Bulb</strong> diameter (mm)</td>
<td>7.0 (10.04±2.91) 15.0</td>
</tr>
<tr>
<td><strong>Leaf sheath</strong> height (cm)</td>
<td>7.0 (13.63±4.55) 20.0</td>
</tr>
<tr>
<td><strong>Leaf blade</strong> Number (ea)</td>
<td>1 (1.40±0.49) 2</td>
</tr>
<tr>
<td><strong>Leaf blade</strong> Length (cm)</td>
<td>15.0 (24.00±3.97) 40.0</td>
</tr>
<tr>
<td><strong>Leaf blade</strong> Width (mm)</td>
<td>2.0 (4.58±2.16) 9.0</td>
</tr>
<tr>
<td><strong>Scape</strong> Length (cm)</td>
<td>12.0 (34.47±8.47) 50.0</td>
</tr>
<tr>
<td><strong>Scape</strong> Width (mm)</td>
<td>2.0 (4.24±2.07) 8.0</td>
</tr>
<tr>
<td><strong>Inflorescence</strong> Flower number (ea)</td>
<td>16 (42.00±15.52) 80</td>
</tr>
<tr>
<td><strong>Inflorescence</strong> Bulbil number (ea)</td>
<td>— 8 (16.25±4.82) 20</td>
</tr>
<tr>
<td><strong>Inflorescence</strong> Height (H, mm)</td>
<td>20.0 (29.20±4.79) 35.0</td>
</tr>
<tr>
<td><strong>Inflorescence</strong> Width (W, mm)</td>
<td>25.0 (32.90±4.18) 40.0</td>
</tr>
<tr>
<td><strong>Inflorescence</strong> H/W (ratio)</td>
<td>0.7 (0.89±0.12) 1.0</td>
</tr>
<tr>
<td><strong>Pedicel</strong> length (mm)</td>
<td>5.0 (6.61±1.14) 10.0</td>
</tr>
<tr>
<td><strong>Bract</strong> length (mm)</td>
<td>11.0 (14.00±2.39) 20.0</td>
</tr>
<tr>
<td><strong>Bulbil</strong> Length (mm)</td>
<td>—</td>
</tr>
<tr>
<td><strong>Bulbil</strong> Width (mm)</td>
<td>—</td>
</tr>
<tr>
<td><strong>Inner tepal</strong> Length (L, mm)</td>
<td>11.0 (12.67±1.25) 15.0</td>
</tr>
<tr>
<td><strong>Inner tepal</strong> Width (W, mm)</td>
<td>2.5 (3.08±0.40) 3.5</td>
</tr>
<tr>
<td><strong>Inner tepal</strong> L/W (ratio)</td>
<td>3.7 (4.12±0.42) 4.8</td>
</tr>
<tr>
<td><strong>Outer tepal</strong> Length (L, mm)</td>
<td>10.0 (12.20±1.57) 15.0</td>
</tr>
<tr>
<td><strong>Outer tepal</strong> Width (W, mm)</td>
<td>2.7 (3.03±0.25) 3.5</td>
</tr>
<tr>
<td><strong>Outer tepal</strong> L/W (ratio)</td>
<td>3.8 (3.97±0.09) 4.1</td>
</tr>
<tr>
<td><strong>Filament</strong> Inner length (mm)</td>
<td>4.0 (5.30±0.77) 7.0</td>
</tr>
<tr>
<td><strong>Filament</strong> Outer length (mm)</td>
<td>3.7 (5.03±0.79) 6.7</td>
</tr>
<tr>
<td><strong>Filament</strong> Anther length (mm)</td>
<td>1.3 (1.40±0.08) 1.5</td>
</tr>
<tr>
<td><strong>Ovary</strong> Length (mm)</td>
<td>2.3 (2.53±0.21) 2.8</td>
</tr>
<tr>
<td><strong>Ovary</strong> Width (mm)</td>
<td>1.8 (2.07±0.25) 2.4</td>
</tr>
<tr>
<td><strong>Ovary</strong> Ovule number*</td>
<td>2</td>
</tr>
</tbody>
</table>
A. schoenoprasum, with minute ridged walls). This character varies among species, but displays consistency within the same taxon. It is particularly useful in distinguishing A. cernuum (Figs. 1C and 1G) from its close relative A. stellatum (Figs. 1D and 1H).

The stomatal apparatus in Allium of the CPP is amphistomatic (found on both sides of leaf) and anomocytic. In A. schoenoprasum, the stomata are more or less raised from the epidermal surface (Figs. 1A and 1E), while in the other taxa these structures are clearly depressed (Figs. 1B–1D and 1F–1H).

**Seed testa sculptures**

Allium testa topography usually involves the analysis of the shape of anticlinal cell walls, including the boundary relief and undulation pattern, as well as the microlrelief of the periclinal cell wall, which is sometimes divided into a central field and a peripheral anticlinal field (Kruse 1992). In the CPP Allium, the more or less flat periclinal walls of the seed coat can be divided in three types: minutely roughened, granulate, and verrucate (Figs. II–1P). The minutely roughened type, characterized by the lack of a relief (although a slight microlrelief may be evident) is an attribute of A. stellatum (Figs. 1L and 1P), and the granulate type is characteristic of A. schoenoprasum and A. textile (Figs. II, IJ, IM, and IN). The verrucate type, distinguished by a conspicuous verruca in the central region of each anticlinal cell wall, is in turn seen in A. cernuum (Figs. 1K and 1O) and A. geyeri (Fig. 19 of Kruse 1988). This demonstrates that seed testa sculpture is a source of traits valuable for Allium taxonomy, and imparts key characters useful for distinguishing closely related species, e.g., A. geyeri from A. textile, and A. cernuum from A. stellatum. Conversely, the straight pattern of the anticlinal cell boundaries is a shared, uninformative character in the taxonomy of the CPP alliums (Figs. 1M–1P), but the putative significance of this character in the systematics of Allium in Canada and (or) the rest of the world should not be ruled out.

**Taxonomic treatment of Allium of the Canadian prairie provinces**

The following taxonomic treatment is based on a wide array of macro- and micro-morphological characters. The reader is advised that characters indicated within square brackets are absent in the species of the CPP but used in the description of Allium in floras and monographs throughout the world.

*A. schoenoprasum, A. textile, A. geyeri, A. cernuum,*

<table>
<thead>
<tr>
<th>Character</th>
<th>Measurement minimum (mean ± SD) and maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capsule</strong></td>
<td></td>
</tr>
<tr>
<td>Length (mm)</td>
<td>4.1 (4.23±0.06)</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>3.2 (3.35±0.11)</td>
</tr>
<tr>
<td><strong>Seed</strong></td>
<td></td>
</tr>
<tr>
<td>Length (mm)</td>
<td>3.3 (3.55±0.08)</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>1.5 (1.65±0.08)</td>
</tr>
</tbody>
</table>

*Number of ovules per locule.*

---

**Table 3 (concluded).**

**Character** | Measurement minimum (mean ± SD) and maximum |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capsule</strong></td>
<td></td>
</tr>
<tr>
<td>Length (mm)</td>
<td>4.0 (4.38±0.22)</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>4.1 (4.4±0.16)</td>
</tr>
</tbody>
</table>

---

*Published by NRC Research Press*
Fig. 1. Epidermal cells of leaf (A–H) and seed testa (I–P) in *Allium* of the Canadian prairie provinces. Figs. 1A–1D, adaxial view; Figs. 1E–1H, abaxial view. From the left to right: *A. schoenoprasum* [H.J. Choi-sk-4 (SASK)]; *A. textile* [H.J. Choi-sk-1 (SASK)]; *A. cernuum* [H.J. Choi-sk-10 (SASK)]; and *A. stellatum* [H.J. Choi-sk-12 (SASK)]. Lc, linear cell; Rc, rectangular cell; Cr, ridged cuticle; Rs, raised stomata; Ds, depressed stomata; Pw, periclinal wall; Aw, anticlinal wall; C, channel; V, verruca.
linear, sometimes with well-developed cuticles; stomatal apparatus usually amphistomatic and anomocytic. Scapes usually central from bulbs, [slender or] stiff, erect to recurved at the upper parts, terete, angular, [or flattened-winged], with 1- to 3-circular vascular bundles, and solid or hollow in cross-section. Inflorescences terminal, usually an umbel, sometimes replaced totally or partially by bulbils, wholly enclosed by a scarious spathe-like bract before flowering; umbels fascicled to globose; pedicels terete [or rarely angular], thinner [or rarely thicker] than the scapes, equal [to distinctly unequal] in length. Flowers bisexual [or rarely unisexual], regular, actinomorphic; perianth campanulate to stellately spreading, with greenish or reddish mid vein abaxially; tepals 6, in 2 series, usually unequal, connate at base, persistent after flowering; inner ones oblong to ovate, acute to obtuse at apex; outer ones oblong to orbicular, acute to subrounded at apex; stamens 6; filaments adnate to the lower part of tepals, exserted or not, connate and usually dilated at base, entire [or toothed at margin]; anthers 2-locular, longitudinally dehiscent, usually elliptical, yellowish [or reddish]; ovary superior, greenish, [reddish, or brownish], trigonous [or not], sometimes with crest-like (apical) or hood-like (basal) appendages, locules 3, ovules usually 2 per locule, placenta axile; style 1, erect, filiform, exserted or not; stigma conically smooth, [capitate, or rarely trifid]. Fruit capsules, dehiscent, [subglobose], ellipsoid, or cordiform, trigonous [or not]. Seeds black, elliptical to circular, flat to circular in cross-section; pericinal walls [smooth], minutely roughened, granulate, or verrucate; anticalinal walls straight, curved [or undulated]. Basic chromosome numbers $x = 7, 8, [or 9]$.

**REMARKS:** In this revision of the CCP *Allium* five species are recognized, namely: *A. schoenoprasum*, *A. geyeri* var. *tenerum*, *A. textile*, *A. cernuum*, and *A. stellatum* (Table 1).

We believe that the existing records of *A. geyeri* var. *geyeri* in the CPP are the result of misidentification of herbarium specimens, the identity of which we have verified to be *A. textile*. Therefore, despite the fact that *A. geyeri* var. *geyeri* is listed as S1 (five or fewer occurrences and particularly vulnerable to extinction) in Saskatchewan (Harms 2003) and as S2 (6–20 occurrences) in Alberta (Kershaw et al. 2001), we propose the exclusion of this species from the rare list in these provinces and thus from the Canadian flora. The records of *Allium* in the Alberta and Saskatchewan Conservation Data centres further support the removal of *A. geyeri* var. *geyeri* from the Canadian Flora.

*Allium tricoccum* is also excluded from this taxonomic study because there is no substantial evidence of its present occurrence in Manitoba, where it was previously reported. Currently, only one specimen of *A. tricoccum* (DAO 157082), a collection by W.R. Leslie in 1923 from Morden, about 60 miles southwest of Winnipeg, exists on record...
Key to the species of the Canadian prairie provinces

1a Leaf blades terete, with two rows of vascular bundles and hollow in cross-section; epidermal cells linear; scapes hollow in cross-section; tepals 10–15 mm long; ovary ellipsoid, with hood-like appendages at base; capsules ellipsoid; seeds elliptical, angular in cross-section. .................................................. 1 A. schoenoprasum

1b Leaf blades flat, channelled, semiterete, or V-shaped, with one row of vascular bundles and solid in cross-section, epidermal cells rectangular to linear; scapes solid in cross-section; tepals 3.8–8.8 mm long; ovary subglobose, without appendages or with crest-like appendage at apex; capsules cordiform; seeds oval to broadly oval, semiterete in cross-section. ......................... 2

2a Rhizomes nearly obsolete, erect, 0.5–2.7 mm long; tunicas of bulbs fibrous, reticulate; outer filaments non-exserted; styles non-exserted; seeds broadly oval. ............................................................... 3

2b Rhizomes condensed, oblique, 2–7.7 mm long; tunicas of bulbs membranous, smooth; outer filaments exserted, seeds oval .......................................................... 4

3a Leaves usually 3 or 4; umbels with 8–20 bulbils; perianth pink to white; ovary with crest-like appendages at apex; seed testa with verrucaeous pericinal cell walls ............................................................. 1 A. geyeri var. tenerum

3b Leaves usually 2; umbels without bulbils; perianth white; ovary without appendages at apex; seed testa with granulate pericinal cell walls .......................................................... 4

4a Leaf blades nearly flat in cross-section; scapes recurved at the upper parts before and after anthesis; perianth campanulate (tepals erect), pink to white, with greenish midveins, inner tepals ovate, 5–6.7 mm × 3–4.3 mm; outer tepals ovate to orbicular, subrounded at apex, 3.8–4.8 mm × 3.1–4.2 mm; inner filaments exserted; seed testa with verrucate or rarely minutely roughened pericinal cell walls .................................................. 1 A. cernuum

4b Leaf blades nearly channelled to V-shaped in cross-section; scapes recurved at the upper parts before anthesis and becoming erect during flowering; perianth stellate (tepals spreading), deep pink, with reddish midveins, inner tepals elliptical-lanceolate, 7.2–7.7 mm × 2.3–3.5 mm; outer tepals elliptical, acute at apex, 6–6.2 mm × 2.8–3 mm; inner filaments non-exserted; seed testa with minutely roughened pericinal cell walls .......................................................... 1 A. stellatum

Allium schoenoprasum L., Sp. Pl. 1: 301 (1753)

LECTOTYPE: Siberia and the Baltic Region. LINN 419.37 (LINN photo!).


LECTOTYPE: Siberia LINN 419.38 (LINN photo!).

= A. schoenoprasum L. var. lautentianum Fernald, Rhodora 28: 167 (1926).

HOLOTYPE: Canada, Newfoundland & Labrador, St. John’s Island, St. John’s Bay: in clay mixed limestone gravel, barren. 31 July 1925, M.L. Fernald et al. 27824 (?; Isotype: NY photo!).

ILLUSTRATION: Figure 3.

DESCRIPTION: Rhizomes condensed, distinctly oblique, 5–10 mm long. Bulbs cylindrically conical, 7–15 mm in diameter; tunics papery, smooth, dark brown. Leaves 1 or 2; leaf sheaths 7–20 cm high; leaf blades terete, with two rows of vascular bundles and hollow in cross-section, acuminate at apex, 15–40 cm × 2–9 mm; epidermal cells linear, with centrally ridged cuticles. Scapes erect before and after flowering, terete, with 2-circular vascular bundles and hollow in cross-section, 12–50 cm × 2–8 mm. Umbels subglobose, 20–35 mm × 25–40 mm, without bulbils, 16–80 flowered; pedicels 5–10 mm long; bracts 11–20 mm long. Perianth campanulate, red with reddish midveins, inner tepals nearly equal to outer ones, oblong-lanceolate, acute at apex, 11–15 mm × 2.5–3.5 mm; outer tepals oblong-lanceolate, acute at apex, 10–15 mm × 2.7–3.5 mm; filament non-exserted, 3.7–7 mm long; anthers 1.3–1.5 mm long; ovary ellipsoid, with hood-like appendages at base, 2.3–2.8 mm × 1.8–2.4 mm; style non-exserted. Capsules ellipsoid, 4.1–4.3 mm × 3.2–3.5 mm. Seeds elliptical, angular in cross-section, 3.3–3.6 mm × 1.5–1.8 mm; pericinal testa cells granulate.

CHROMOSOME NUMBER: 2n = 16 (Chinnappa and Basappa 1986; McNeal and Jacobsen 2002).

DISTRIBUTION: Europe, Asia, and North America.

CANADIAN PRAIRIE PROVINCES: Wet meadows, rocky or gravelly mountain slopes, stream banks, and lake shores of Alberta, Saskatchewan, and Manitoba (Fig. 2A).

PHENOLOGY: Flowering from June to August.

REMARKS: Owing to the difficulty in separating native populations from those that appear to have escaped from cultivation, McNeal and Jacobsen (2002) were not able to accurately map the distribution of this native species. In this revision and according to voucher specimens, we propose a distribution including boreal areas, mountainous regions, and
Taiga Shield of the CPP, except the central and southernmost areas of the prairies (Fig. 2A).

CONSERVATION STATUS: This species has been listed as a rare plant in Saskatchewan. It is ranked as S2 by the Saskatchewan Conservation Data Centre (SCDC) (2009). Harms (2003) includes it in the threatened (THR) category, which indicates an imperilled species likely to become endangered due to its rarity. Our distribution map confirms the rare status of this species as evidenced by the existence of few collections in Saskatchewan and Manitoba, with five and four localities, respectively (Fig. 2A). To our knowledge, there is no designation record about this plant’s rarity status in Manitoba. We recommend a more thorough survey to evaluate its distribution and demography to accurately determine the rarity category of this species.

Allium geyeri S. Watson var. tenerum M.E. Jones, Contr. W. Bot. 10: 28 (1902)


ILLUSTRATION: Figures 4B–4F.

DESCRIPTION: Rhizomes nearly obsolete, erect, 1.2–2.7 mm long. Bulbs ovoid, 7–15 mm in diameter; tunicas fibrous, reticulate, gray to light brown. Leaves 3–5; leaf sheaths 5–13 cm high; leaf blades flat to adaxially channelled, with one row of vascular bundles and solid in cross-section, ob-tuse at apex, 12–25 cm × 2–4 mm. Scapes curved before anthesis and becoming erect in flowering, terete, with 2-circular vascular bundles and solid in cross-section, 15–50 cm × 1.5–3.1 mm. Umbels hemispheric to globose, 15–22 mm × 18.4–26 mm, 5–13 flowered, flowers mostly replaced by 8–20 bulbils; pedicels 5–17 mm long; bracts 7–11 mm long. Perianth campanulate to urceolate, pink to white, with reddish midveins, inner tepals narrower than outer ones, oblong to lanceolate, acute to obtuse at apex, 8–8.5 mm × 2–2.5 mm; outer tepals oblong to lanceolate, acute to obtuse at apex, 7.5–8.5 mm × 2.5–3.5 mm; fila-ments non-exserted, 6–8.3 mm long; anthers 1.1–1.5 mm long; ovary subglobose, with crest-like appendages at apex, 2.3–3.1 mm × 2–3 mm; style non-exserted. Capsules cordi-form. Seeds broadly oval, semicircular in cross-section; periclinal testa cell walls verrucose (Fig. 19 of Kruse 1988).

CHROMOSOME NUMBER: 2n = 28, 35, 42 (McNeal and Jacobsen 2002).

DISTRIBUTION: North America.

CANADIAN PRAIRIE PROVINCES: Meadows and damp places along streams in mountainous areas of southwesternmost Alberta (Fig. 2D).

PHENOLOGY: Flowering from June to July.

CONSERVATION STATUS: This variety has been listed as S2 together with var. geyeri in Alberta (Kershaw et al. 2001). Although field population studies are lacking, herbarium records indicate that A. geyeri var. tenerum is the rarest Allium...
species in the CPP. Its distribution is restricted to the Waterton Lakes National Park areas of Alberta (Fig. 2D). The rarity of this taxon in Canada may be correlated with this species being at its northernmost range limits, as it is a relatively common species in the US (McNeal and Jacobsen 2002). Regardless of this distributional pattern, proactive research (such as population monitoring) should be implemented to protect this species in Canada in an effort to understand the geographic range limits of the Canadian population, which is a key issue in conservation biology.

**Allium textile** A. Nelson & J.F. Macbride, Bot. Gaz. 56: 470 (1913)

**HOLOTYPE.** United States: banks of the Missouri. Collected by Nuttall. Plate No. 1840 (Bot. Mag. 43, 1815!).


**HOLOTYPE.** United States: Wyoming, Green River. 25 June 1895. P.A. Rydberg 2605 (NY; isotype: NY photo!).

**ILLUSTRATION.** Figure 5.

**DESCRIPTION.** Rhizomes nearly obsolete, erect, 0.5–2.3 mm long. Bulbs ovoid, 7–25 mm in diameter; tunicas fibrous, reticulate, gray to light brown. Leaves 2–4; leaf sheaths 3.5–10 cm high; leaf blades adaxially channelled to semiterete, with one row of vascular bundles and solid in cross-section, acuminate to acute at apex, 8–20 cm \( \times \) 1–3 mm; epidermal cells rectangular to linear, with smooth cuticles. Scapes curved before anthesis and becoming erect in flowering, terete, with 2-circular vascular bundles and solid in cross-section, 10–37 cm \( \times \) 0.8–3 mm. Umbels subfascicled to hemispheric, 12–42 mm \( \times \) 18–55 mm, without bulbils, 7–41 flowered; pedicels 4–20 mm long; bracts 7.5–16 mm long. Perianth campanulate to urceolate, white, with reddish midveins, inner tepals narrower than outer ones, oblong, obtuse at apex, 4.5–8.8 mm \( \times \) 2–2.8 mm; outer tepals broadly ovate to lanceolate, acute to obtuse at apex, 4–7.8 mm \( \times \) 2.5–3.9 mm; filaments non-exserted, 2.7–5.3 mm long; anthers 0.9–1.5 mm long; ovary subglobose, without appendages, 1.3–2 mm \( \times \) 1.4–1.9 mm; style non-exserted. Capsules cordiform, 3.5–4.6 mm \( \times \) 3.6–5.2 mm. Seeds broadly oval, semicircular in cross-section, 2.5–3 mm \( \times \) 1.8–2.1 mm; periclinal testa cell walls granulate.

**CHROMOSOME NUMBER:** \( 2n = 14, 28 \) (Chinnappa and Basappa 1986; McNeal and Jacobsen 2002).

**DISTRIBUTION:** North America.

**CANADIAN PRAIRIE PROVINCES:** Dry grasslands, hills, and river-sides of Alberta, Saskatchewan, and Manitoba (Fig. 2B).

**PHENOLOGY:** Flowering from May to July.

**REMARKS:** *Allium textile*, the most widespread species of the genus in the CPP (Fig. 2B), exhibits extreme variability in plant length, leaf number, and floral size. Although the leaves are in general two, some specimens may have three
or four leaves (Table 3). Based on field observations, we noted that individuals with three or four leaves (H.J. Choi-sk-2) tend to develop a longer perianth than those individuals with two leaves (H.J. Choi-sk-1). Specimens of A. textile with more than three leaves have been misidentified as A. geyeri var. geyeri in various Canadian herbaria, but the former is easily distinguished from the related A. geyeri var. geyeri by its white perianth (as opposed to pink to white) and absence of crest-like ovarian appendage (as opposed to distinct appendages), as well as a longer pedicel and shorter scape (Tables 2 and 3; Figs. 4A and 5). Similarly, the type specimen of A. geyeri var. geyeri from the Rocky Mountains filed at NY (G. Vasey s.n., isosyntype) shows several differences from the Canadian (Alberta and Saskatchewan) specimens labeled “A. geyeri var. geyeri”, especially in inflorescence size and perianth colour. Moreover, A. textile is easily distinguished from A. geyeri because the former has granulate seed testa cell walls without verrucae (Figs. 1J and 1N), while the latter is known to have verrucate walls (Fig. 19 of Kruse 1988; McNeal and Jacobsen 2002).

Allium cernuum Roth, Arch. Bot. (Leipzig) 1: 40 (1798)


HOLOTYPE: United States: Montana, mountain near Indian Creek, alt. 8000 ft. a.s.l. 2 July 1897, P.A. Rydberg & E.A. Bessey 3850 (NY photo!).

ILLUSTRATION: Figure 6.

DESCRIPTION: Rhizomes condensed, oblique, 2–7.7 mm long. Bulbs ovoid, 8.3–22 mm in diameter; tunicas membranous, smooth, gray to brown. Leaves 3–7; leaf sheaths 3–10 cm high; leaf blades nearly flat, with one row of vascular bundles and solid in cross-section, acuminate to obtuse at apex, 5–27.5 cm × 1.2–8 mm; epidermal cells rectangular to linear, with smooth cuticles. Scapes recurved at the upper parts before and after anthesis, terete to angular, with 2- to 3-circular vascular bundles and solid in cross-section, acuminate to obtuse at apex, 5–27.5 cm × 1.2–8 mm; epidermal cells rectangular to linear, with smooth cuticles. Scapes recurved at the upper parts before and after anthesis, terete to angular, with 2- to 3-circular vascular bundles and solid in cross-section, acuminate to obtuse at apex, 13.5–48 cm × 1.1–4 mm. Umbels hemispheric to globose, 17–42 mm × 21–46.3 mm, without bulbils, 12–42 flowered; pedicels 6–20 mm long; bracts 9–13.5 mm long. Perianth campanulate, pink to white, with greenish midveins, inner tepals unequal to outer ones, ovate, acute at apex, 5–6 mm × 3–4.3 mm; outer tepals oval to orbicular, sub-
rounded at apex, 3.8–4.8 mm × 3.1–4.2 mm; filaments exserted, 3.5–9 mm long; anthers 1.8–2 mm long; ovary sub-globose, with crest-like appendages at apex, 2.2–3 mm × 2.4–3 mm; style exserted. Capsules cordiform, 3.8–6.5 mm × 4.3–6.5 mm. Seeds oval, semicircular in cross-section, 2.5–3.8 mm × 2–2.4 mm; periclinal testa cell walls verrucate or very rarely minutely roughened.

CHROMOSOME NUMBER: \(2n = 14\) (Chinnappa and Basappa 1986; McNeal and Jacobsen 2002).

DISTRIBUTION: North America.

CANADIAN PRAIRIE PROVINCES: Dry hills and arid slopes of Alberta and Saskatchewan (Fig. 2C).

PHENOLOGY: Flowering from June to August.

REMARKS: Taxonomically, *A. cernuum* is closely related to *A. stellatum* (McNeal and Jacobsen 2002). The character most commonly used to differentiate these two species is the orientation of the umbel-shaped inflorescence. In both species, the inflorescence may often be nodding (recurved) in the budding stage, but in *A. stellatum* the inflorescence usually becomes erect during anthesis (Figs. 7A and 7B). In *A. cernuum*, the scape remains permanently curved near the apex (Figs. 6A and 6B), but sometimes the inflorescence may become erect or nearly so (McNeal and Jacobsen 2002; Choi and Cota-Sánchez 2009). In addition, the perianth shape in *A. cernuum* is campanulate with ascending tepals (Table 2; Fig. 6G), while in *A. stellatum* it is stellate with apically spreading tepals (Fig. 7G). Also *A. cernuum* differs from *A. stellatum* in having verrucate seed testa periclinal cell walls (Figs. 1K, 1L, 1O, and 1P).

CONSERVATION STATUS: Despite being one of the most widespread North American species of the genus (McNeal and Jacobsen 2002), *A. cernuum* is quite rare in Saskatchewan and is ranked as S1S2 by the SCDC. Similarly, Harms (2003) includes it in the vulnerable (VUL) category, which indicates a species at risk because of the declining numbers and typically found in 16 to 25 sites, which are reasons for special concern. Various populations of *A. cernuum* have been reported in two localities of Saskatchewan, one in the Meadow Lake area (central-western Saskatchewan) and another one in the Cypress Hills region (southwestern Saskatchewan) (Fig. 2C). We found a population of this species in the latter locality in July 2009 (Fig. 6), located near roads and margin of cliffs at an altitude of ca. 1300 m a.s.l. growing together with *Apocynum androsaemifolium* L., *Campanula rotundifolia* L., *Eriogonum flavum* Nutt., *Monarda fistulosa* L., and *Potentilla fruticosa* L. (Choi and Cota-Sánchez 2009). Contrary to McNeal and Jacobsen (2002), who indicate that *A. cernuum* prefers moist soils in mountainous and cool regions, the southwestern Saskatchewan population of *A. cernuum* occurs on dry, gravelly to sandy soils. Field data and label specimens indicate that the flowering period of this population occurs from the second week of July to...
the first week of August (although 2009 may have been a somewhat atypical year for phenotypic observations, V. Harms, University of Saskatchewan, personal communication, 2010). In terms of population size and number of individuals, our estimate in southwestern Saskatchewan is about 300 individuals, distributed in an area of ca. 0.5 ha. In some areas it was locally abundant, to the extent that it formed an herbaceous mat.

According to herbarium records from 1949 and 1950 at SASK, *A. cernuum* has been collected at Meadow Lake, Alcott Creek, and two other nearby areas in the central-western portion of the province. Nonetheless, the original fescue prairie habitat indicated in label specimens no longer exists, especially in areas near roads. In addition, the recent clearing of the original vegetation and the prevailing habitat in Alcott Creek and surrounding areas, which are quite swampy and unsuitable for *A. cernuum* to grow, have apparently played a major role in the perceptible waning of this population (K. Remarchuk, University of Saskatchewan, personal communication, 2010). Conversely, during our summer 2009 visit to the Central Block locality of the Cypress Hills population, we found only two individuals. It is likely that the low population number of *A. cernuum* in the Central Block is due to ecological factors affecting the reproductive rate. Although more fieldwork is necessary to have an accurate assessment of the current populations, some inferences can be made with these data and observations. Foremost, it appears that the general Meadow Lake area population have vanished, at least from the most accessible areas, primarily because of human activities, which suggests the need for the enforcement of better conservation practices in the preservation of species at risk. Our data for the southwestern population are encouraging in terms of population demographic number, suggesting that this species might not be well categorized within the S1S2 rank as indicated by the SCDC and Harms’ VUL status may be more appropriate as this species is locally abundant. However, considering that the existence of the Meadow Lake population is questionable, and only a couple of individuals were recorded in the Cypress Hill, we recommend maintaining the rank of this species as S1S2 until wide-ranging surveys are conducted in these two localities.

*Allium stellatum* Ker Gawler, Bot. Mag. 38: 1576 (1813)

**Holotype:** United States: banks of the Missouri. Collected by Nuttall. The drawing was taken from an imported specimen that bloomed at Fraser’s nursery, in Sloane-Square, in late June. Plate No. 1576 (Bot. Mag. 37–38, 1813!).

**Illustration:** Figure 7.

**Description:** Rhizomes condensed, oblique, 2–7 mm long. Bulbs ovoid, 8–17.7 mm in diameter; tunicas membranous, smooth, gray to brown. Leaves 3–7; leaf sheaths 5–11 cm high; leaf blades channelled to V-shaped, with one row of...
vascular bundles and solid in cross-section, acutaneous to acute at apex, 15–36 mm × 1–3.6 mm; epidermal cells rectangular to linear, with centrally ridged cuticles. Scapes usually recurved at the upper parts before anthesis and becoming erect in flowering, terete to dully angular, with 2- to 3-circular vascular bundles and solid in cross-section, 25–62 mm × 1.3–2.8 mm. Umbels subascissed to hemispheric, 16–34 mm × 24–48.2 mm, without bulbs, 10–54 flowered; pedicels 8.5–20.2 mm long; bracts 9.3–19.7 mm long. Perianth stellate, deep pink, with reddish midveins, inner tepals unequal to outer ones, elliptical-lanceolate, acute at apex, 7.2–7.7 mm × 2.3–3.5 mm; outer tepals elliptical, acute at apex, 6–6.2 mm × 2.8–3 mm; filaments exerted (outer) or not (inner), 7–7.5 mm long; anthers 2–2.4 mm long; ovary subglobose, with crest-like appendages at apex, 2.7–3.2 mm × 3–4 mm; style exerted. Capsules cordiform, 4–5 mm × 4.1–5 mm. Seeds oval, semicircular in cross-section, 2.5–3.3 mm × 1.5–2.2 mm; periclinal testa cell walls minutely roughened.

**CHROMOSOME NUMBER:** 2n = 14 (McNeal and Jacobsen 2002).

**DISTRICTION:** North America.

**CANADIAN PRAIRIE PROVINCE:** Open plains and wooded areas of Saskatchewan and Manitoba (Fig. 2D).

**PHENOLOGY:** Flowering from July to September.

**REMARKS:** This species is widely distributed and relatively common in the prairie and adjacent boreal plains of southeastern Saskatchewan and southern Manitoba. Its closely related species, *A. cernuum*, occurs allopatrically in the mountainous and boreal shield areas of western Alberta and two isolated parts of Saskatchewan (Figs. 2C and 2D).

**Acknowledgements**

We are thankful to V. Harms and D. Litwiller for comments on early drafts of the manuscript; C. Peters and D. Peters provided assistance in the mapping process. We also thank E. Punter for helping us to track *A. tricoccum* in Manitoba, the curators of ALTA, DAO, LINN, MO, NY, SASK, and WIN for lending material for study, and to SASK personnel for their assistance and for facilitating the loan of material. This research was partially supported by the Canada Foundation for Innovation, the Flora of Saskatchewan, the Museums Assistance Program, and the Canada Foundation for Innovation, the Flora of Saskatchewan, the Museums Assistance Program.

**References**


Kruse, J. 1988. Rasterlelektronenmikroskopische untersuchungen an...


---

**Appendix A. List of representative specimens examined in this study**

The specimens used for quantitative characters are indicated with an asterisk (*).

*Allium schoenoprasum* L.

Allium geyeri S. Watson var. tenerum M.E. Jones


Allium textile A. Nelson & J.F. Macbride

1963, B. de Vries 2317-64 (DAO 154073); immediately north of Alberta Biological Station, 14 June 1961, J.R. Corefoot & E.H. Moss s.n. (ALTA 096211); north bank of Sheep River, west of Beaver Pond, 14 June 1966, B.J. Golberg 148 (ALTA 71415); Allerston, 26 June 1958, B. Boivin & J.M. Perron 12230 (DAO 126253); Hooods, 7 miles east of Drumheller, 20 May 1963, P. Barclay 919 (ALTA 102150).

Saskatchewan. Frenchman Creek badlands, 27 May 1969, J. Looman 12270 (SASK 102215); Little Woody, 30 June 1926, L. Marie s.n. (DAO 777538); Antler, 24 June 1951, B. Boivin 7425 (DAO 777551); Moosomin study area, NE 1/4 Sec 35 T13 R2 W1, 16 June 1968, M. Dennington s.n. (SASK 124526); Oxbow, 12 miles south of Indian Head, 3 June 1965, J. Looman 13962 (SASK 83432*); Redberry Lake, 23 June 1929, G. W. Selleck s.n. (DAO 777550*); Lakeview, 2 miles south of Saskatoon, 9 June 1971, J. Looman 12227 (SASK 102221).
Allium cernuum Roth

Prairie, west of Calgary, 14 July 1946, E.H. Moss 7135 (ALTA 4796*); left shore of Bow River of Bowman Park, Calgary, 9 July 1944, G.H. Turner 4142 (ALTA 36513); near Midnapore, south of Calgary, 12 August 1950, W.C. McCalla 11277 (ALTA 37193); 7 miles southwest of Lundbreck, 18 July 1967, J. Looman 10774 (SASK 102193); Oldman River valley, 2 miles west of Maycroft, 31 July 1976, D. Coxson 143 (ALTA 85574); 5 miles east of Bellevue, 16 July 1974, Hainault 6513 (DAO 833314); Big Hill Springs Provincial Park, 2 August 1967, J. Looman 11078 (SASK 102195); Racehorse Creek, 21 July 1967, J. Looman 10840 (SASK 102192*); up hill overlooking Racehorse Creek, west of Gap Ranger Station, Crownest Forest Reserve, 30 July 1955, R.G.H. Cormack 228 (ALTA 23877*); Mt. Timothy and up to Fly Hill, 28 July 1955, R.G.H. Cormack 214 (ALTA 23879*); in the region between the headwaters of the Oldman and Livingston rivers, 12 August 1975, D. Jaques 5772 (ALTA 900072); Livingstone Falls, 22 July 1967, J. Looman 10878 (SASK 102194); Highway 3, 5 miles east of BC border, 16 July 1974, Hainault 6548 (DAO 833314); Coyote Lake Nature Sanctuary, 11 July 2008, D.M. Fabijan 3208 (ALTA 120062); bridge on Sheep River at mile 12 along Sheep for- estry Road, vicinity of Gorge Creek, University of Alberta, Dept. of Zoology, RB Miller Biological Station, 11 July 1961, J.R. Carefoot s.n. (ALTA 096210); near the Crownest summit, 13 August 1974, Reid et al. 1136 (ALTA 75846*); on road to Sundre from Nordegg-Cochrane Forestry Road, 24 June 1974, M. Dumais 7004 (ALTA 71920); xeric south-facing slopes in the Marmot Creek Basin cirque, Mt. Allan, 6 August 1975, S. Carroll 180 (ALTA 76690); Carbondale area, 5 July 1949, A.C. Budd 3302 (SASK 102241*); Barrier Lake, Kananaskis Forest Experimental Station, 25 July 1950, R.D. Whitney 50/242 (DAO 123419); south-southeast-facing grass-forbs slopes on northeast flank of Mt. Heart, northwest of Barrier Lake, near Mt. Pidgeon fire lookout, 2 July 1973, s.n. (ALTA 900062); Boulton Creek Cabin, 27 July 1976, D.F. Brunton 1186 (DAO 169750*); Kananaskis Country, 26 August 1993, K. Olson 17 (WIN 54152); Highwood Pass, mile 92 Kananaskis Forestry Road, west-facing slope of Highwood Range, 5 miles northwest of Mt. Head, 8 August 1969, J.G. Packer 1969- 398 (ALTA 27099*); Banff National Park, 9 August 1966, R. Hnatiuk s.n. (ALTA 104289); Banff National Park, Banff Area, Mt. Sulphur, southwest of Village, 3 September 1984, V. L. Harms 33689 (SASK 124867); Mt. Cascade, Banff National Park, 6 August 1962, P. Barclay 660 (ALTA 102918*); Upper Hot Springs, Banff National Park, 3 August 1940, E.H. Moss 5019 (ALTA 4794); Banff National Park, 5 August 1966, R. Hnatiuk s.n. (ALTA 41075); Bow River Valley, southwest slope of Mt. Cory, 6 miles west of Banff, 22–25 June 1945, A.E. Porsild & A. J. Breitung 13129 (ALTA 100025); Banff National Park, Mt. Bourgeau, 10 miles west of Banff, A.J. Breitung et al. 3313 (DAO 121761); Redeearth Creek, Banff National Park, 8 July 1967, P.W. Stringer s.n. (ALTA 41523*); Mt. Eisenhower Forest Experiment Station, Banff National Park, 14 July 1968, T. Mosquin & J.R. Seaborn 7107 (DAO 123400*); Windy Point Ridge, west of Highway 11, overlooking Abraham Lake, 14 August 2007, D.M. Fabijan 2822 (ALTA 118164*); Windy Point, 22 miles west of Nordegg, 29 Au- gust 1968, M.G. Dumais 4758 (ALTA 28759); Kootenay Plains Ecological Reserve, 10 July 2007, D.M. Fabijan 2607 (ALTA 118163*); Cline River, at bridge on the David Thompson Highway, 27 mile east of Jasper-Banff park boundary, 2 July 1968, M.G. Dumais & K. Anderson 2915 (ALTA 28664*); about 7 miles west of Peace River town, 5 August 1971, B. Heywood 203 (ALTA 39412); Peace River, 16 August 1946, H. Groh 2781 (DAO 123395); vinity of Jasper, 2 miles east of town, 14 July 1960, A.E. Porsild 22500 (ALTA 100217*); Jasper National Park, 1 km north- west of Henry House, 16 July 1974, T.D. Lee & W.M. Peterson s.n. (ALTA 56137); Jasper National Park, Pyramid Bench, 17 September 2005, S. Griffith s.n. (ALTA 115063); Jasper Fish Hatchery, Jasper National Park, 12 July 1967, P.W. Stringer s.n. (ALTA 41525); 6 miles west of Dunvegan on grass slope of Piece River, 16 May 1977, C. Wallis s.n. (ALTA 75467); Saddle River Valley Wanham, Prestville region, 20 July 1947, E.H. Moss 7427 (DAO 123390*); Sprit River, Peace River District, 13 September 1939, H. Groh 953 (DAO 123394); Forestry Trunk Road, Wilson Creek, 22 August 1967, J. Looman 11372 (SASK 102191*); along Peace River between BC border and Dunvegan, north shore of Piece River just west of larg- est island chain, 23 July 1981, H.L. Dickson & E. Harsaeni 4857 (DAO 690157); near Bear Lake, Grand Prairie area, 8 August 1952, D.R. Lindsay 316 (DAO 123391); Red Willow River, 14 miles southwest of Beaverlodge, 27 July 1947, L. Jenkins 339 (DAO 123396); Experimental station, Beaverlodge, 2 miles WE of station, 2 July 1947, L. Jenkins 313 (DAO 123397).

Saskatchewan. Meadow Lake, 10 July 1950, W. MacNeill 35014 (DAO 123384); Rapid View, ca. 50 km west of Meadow Lake town, 3 June 1952, W.J. Bobier 3 (SASK 102240); Ravenscrag Butte, 6 August 1981, J.H. Hudson 4174 (SASK 72872*); Cypress Hills, T8, R26, S27, 27 July 1964, R.D. Newsome 500-64 (DAO 123373*); Center Block Cypress Hills, southeast 1/4 17-8-26W3rd, 2 September 1957, J.H. Hudson 2110 (DAO 123382); Cypress Hills Provincial Park, Lookout Point, 9 August 1972, V.L. Harms 19225 (SASK 46600*); Cypress Hills, Gap road between CB & WB, 5 July 2003, Randy & Olson s.n. (SASK 086851); Cypress Hills, west Block, From east boundary of park to 1 km west of entrance NW1/4 Sec 31 T7 R28 & NE1/4 Sec 36 T7 R29 W3, 14 July 1986, B. Heywood 203 (DAO 123374*); Birch Creek Ranger Station, Cypress Hills, 15 July 1947, A.J. Breitung 4836 (DAO 123375*); Cypress Hills: T8, R30, S12, 27 July 1962, R.D. Newsome 162-62 (SASK 27247*); Beaver Trail, Cypress Hills Park, 11 August 1974, Hainault 7122 (DAO 139552); West Block of Cypress Hills, 20 July 2000, J.H. Hudson 5458 (SASK 149940*); Alcott River, Meadow Lake Forest Reserve Woodlang, 16 May 1949, W. MacNeill 52993 (DAO 123383; SASK 83810); Conglomerate Cliffs, Cypress Hills Interprovincial Park, 22 July 2009, H.J. Choi- sk-10 (SASK*).

Allium stellatum Ker Gawler

CANADA: Saskatchewan. Piwei Hills, 24 July 1949, J.S.Rowe 1190 (DAO 386795); Spalding, 2 August 1954, G.W. Selleck & Verla 132 (DAO 123331); Bison enclosure,
north of Lake Audy, 13 August 1979, W.J. Cody 24658 (ALTA 105034*); east of Prince Albert, Forest Reserve, SE1/4 Sec 31 T48 R23 W2, 7 August 1996, D. Paterson 13 (SASK 140466); Welby, 24 July 1943, J.A. Campbell s.n. (SASK 102248); Carduf, 15 July 1938, J.L. Bolton s.n. (SASK 102236); southeast of Wawota (northeast of Carl-lyle), 4 August 1981, K. Kennet 48 (SASK 75793*); Wawota, 13 August 1948, R.C. Russell 4870 (DAO 123345); Bredenburg, T23 R33 W1, 11 July 1981, A. Schewe & B. Consul 140a (SASK 75943); Amisk Lake, 1.25 miles north of Denare Beach, 30 July 1954, J.H. Hudson 1543 (DAO 123329); 2 miles west of Wroxton, T26 R34 W1, 7 August 1992, M. Diduck 09 (SASK 135986); Pepew Prairie, south of Pepew lake, 4.1km south of Mcbride Lake Road, 25 July 1985, V.L. & R.M. Harms 34612 (DAO 701487); Moose Mountain Creek Valley, 10 miles north & 0.5 to 1 mile west of Oxbow, 26 July 1987, V.L. Harms 38163 (SASK 129347); Oxbow, 15 August 1962, J. Looman 7221 (SASK 102254*); Moose Mountain Creek Valley, ca. 1 mile above confluence with Souris River, 25 July 1987, V.L. Harms 38109 (SASK 129244*); Pepew River, 8.2 km east of McBride Lake Resort, along “McBride Lake Road”, 25 July 1985, V.L. & R.M. Harms 34573-A (DAO 689535); 10 miles au nord de Whitehood, 5 August 1951, B. Boivin & J.M. Cilleit 8539 (DAO 123351); Pepew River bluffs, 9 July 1981, V.L. Harms et al. 29652 (SASK 93798); Langbank, 5 August 1953, A.B. Dickey 22-32 (SASK 93722); 4 miles west of Stockholm, 15 August 1963, J.F. Alex & J. Gebradt 1241 (DAO 643668); 1 mile north of Hudson’s Bay Junction, 23 July 1940, A.J. Breitung 727 (ALTA 36303*; DAO 123337); Yorkton, 26 July 1946, W.J. Cody 1946 (DAO 123343); Waldron, 26 August 1914, S.J. Neville 1138 (DAO 123338); Sturgis, 23 July 1886, D.F. Hooper & L. Baker 86072317 (SASK 83544); Stoughton area, LSD 2NE1/4 Sec 1 T06 R05 W2, 15 July 1997, J. Marchand & C. Bradley s.n. (SASK 141866*); north of Kipling, near Pipistone Creek, 17 July 1981, T. Misfeldt 129 (SASK 74988*); Good Spirit Lake, along southwest side, 24 July 1985, V.L. Harms 34441 (SASK 127666); Shoal Lake Indian Reserve, Carrot River Valley, ca. 0.5km west of Pakwak lake village, 18 July 1984, V.L. Harms et al. 32580 (DAO 687860); 4 km south of Reserve, ca. 0.5 km west of Highway 9 on Piwee Forest Road. Just north of Etomami River and west of confluence with Piwee River, 28 July 1985, V.L. & R.M. Harms 34637 (SASK 127663); Good Spirit Lake, southwest side, 21 July 1985, V.L. & R.M. Harms 34331 (DAO 701495); north of Crooked Lake, 27 July 1959, B. de Vries 226 (DAO 123327); Melville, 31 July 1933, H. Groh s.n. (DAO 123340); Tecumseh, S15, T10, R7 west 2nd, 14 August 1962, J. Looman 7121 (DAO 123353); Souris River Valley, ca. 3 miles west to southwest of Estevan, NW1/4 Sec 18 T2 R8 W2, 20 July 1987, V.L. & R.M. Harms 37864 (SASK 129243); 6 miles west of Cornig, 30 July 1982, J.H. Hudson 4241 (SASK 171823); Souris River Valley, southwest corner of NE1/4 Sec 34 T2 R9 W2, 17 July 1987, V.L. & R.M. Harms 37713 (DAO 736352); Macoun, 14 August 1950, W.G. Dove & A.J. Breitung 12557 (ALTA 4840); Greenwater Lake, 8 August 1987, D. Miller 8738 (SASK 90222); 12 miles north of Balcarres, 22 July 1978, J.H. Hudson 3608 (DAO 335495*); Fishing Lake, 3 August 1985, R.R. Hooper 85080309 (SASK 83722*); Bjorkdale, ? June ?, J. Laycock s.n. (DAO 123348); Pre Ste Marie, 28 July 1933, A.J. Breitung s.n. (DAO 123336); Strawberry Lakes, 12 miles south of Indian Head, 5 August 1971, G.J. Jones 854 (DAO 658472*); Kelliher, 6 August 1928, R.C. Russell s.n. (SASK 83413); New Osgood, 11 July 1912, S.J. Neville 1135 (DAO 123344); Wellington PFRA Community Pasture, 1 August 1985, B. Kishchuk 94 (DAO 123381); West of Prince Albert, National Historic Site of Canada, 88 km northeast of Saskatoon, 15 August 1954, J.A. Campbell s.n. (DAO 123348); Wellington PFRA, north end at Last Mountain Lake, 29 August 1985, T. Jorgenson 8 (SASK 81309*); Middle Lake, 18 July 1910, W. Robbins 63 (DAO 123352*); Carmel, 28 July 1957, R.C. Russell S 57008 (SASK 83404); Bruno, 28 July 1957, R.C. Russell 57014 (DAO 123328*); Martensville, 1 August 1952, E. Ching et al. 1095 (SASK 171819*); outskirts of Prince Albert, 28 July 2001, A. Germann 46 (SASK 160757*); north Prince Albert, Little Red River Regional Park, 28 July 2001, S. Crouthtch 37 (SASK 160527); Young, 23 August 1956, J. Looman 614 (SASK 102256); Prince Albert, 26 July 1954, M.A. Welsh s.n. (SASK 2582); 1 mile north of St. Louis, 11 August 1946, H.A. Senn et al. 2795 (DAO 123334); Macdowall, 10 September 1959, R.C. Russell S59116 (SASK 83403); Macdowall, 28 July 2009, H.J. Choi-sk-12 (SASK*); Martensville, 11 August 2009, H.J. Choi-sk-16 (SASK*); Batoche National Historic Site of Canada, 88 km northeast of Saskatoon, ? ? 1988, E. Hooper s.n. (SASK 176916); Duck Lake Site 1, 5 miles northeast, 19 August 1955, G.W. Selleck 328 (DAO 123330); Rosthem, 30 July 1916, s.n. (SASK 6741*); Shellbrook, 19 August 1910, s.n. (SASK 6740); Prince Albert National Park, where Fox Creek joins the Sturgeon River, 18 August 1972, T.F. Cameron 664 (SASK 55168*); south of Beaver creek bridge, south of Saskatoon, 25 August 1968, H. Nusche 6813 (ALTA 116895); Sturgeon Lookout Point, 10.6 km southeast of Sturgeon Crossing on West Boundary Road, about 1 km south of road, 21 July 2003, V.L. Harms 44367 (SASK 162555*); 2–3 miles northeast of Sutherland along road near river, 14 August 2007, H. Nusche 66/32 (ALTA 116896); ca. 1 mile north of Saskatoon, 26 July 1993, M. Lineman 9310-149 (SASK 169357*); north of Junction highways 5 & 11, 26 July 1971, N.A. Skoglund 587 (SASK 43511); Saskatoon, 12 July 1922, W.P. Fraser s.n. (SASK 83410*); Martensville, 0.5 miles west & 1 mile north off Main Street, 23 June 1996, V. Leuschen s.n. (SASK 141474); Wasstrom’s Flats, southwest 1/4 S27 T54 R05 W3, 19 July 2003, V.L. Harms

Published by NRC Research Press
44271 (SASK 164264*); 6.4 km north of Saskatoon, 4 August 2008, C. Peters 65 (SASK 179169*); Saskatoon, north part NE 1/4 18-36-SW 3rd, 8 September 1951, J.H. Hudson 833 (DAO 123335); Biddulph Half-Section Natural Area (University of Saskatchewan Study Area), 21 miles north of Saskatoon along Rt. 219, just north of White Cap Indian Reserve, 5 August 1982, V.L. Harms 31308 (DAO 734464*); Shell Lake, 27 July 1988, J.H. Hudson 4801 (SASK 88798*); Manitou Lake, 1 August 1947, C. Franke & R. Bibeau 426 (DAO 123346), 6 miles north of Peebles, 31 July 1953, G.W. Selleck 31 (DAO 102257); Roseneath School District, 8 August 1956, H.D. Senn & D.L. Senn, Lisgar District, 20 August 1946, C. Peters 65 (DAO 102258); Benito, 2 September 1951, H. J. Scoggan 10091 (WIN 7718*); Virden, 23 July 1921, H. Groh s.n. (DAO 123314); Melita, in southwest corner of Manitoba, 23 July 1951, H.J. Scoggan 9896 (ALTA 4842); Lyleton, 20 miles southwest of Melita, 2 August 1953, H.J. Scoggan 11157 (ALTA 4841); Saint-Lazare, 8 July 1951, B. Boivin & W.G. Dore 7730 (DAO 123319); Assissipi, 29 July 1985, J.L. Parker 85-786 (WIN 42438); Cranberry portage, ? June 1950, N.J. Freedman s.n. (WIN 7709*); Duck Mountain Provincial Park, east of Boggy Creek, 26 July 1968, J. Looman 11895 (SASK 102255); east of Boggy Creek Park, 10 August 1970, J. Looman 15400 (SASK 102258); near Victor, 24 July 1943, J.A. Campbell s.n. (SASK 102247); Benito, ?, L.S. Matthews s.n. (WIN 7708); Shoal Lake, 15 July 1989, L.M. Ross s.n. (WIN 49602*); Quesnel Lake, 4 August 1974, G.M. Keleher 74-250 (WIN 28576); Bird River, 11 July 1981, K.A. Frew s.n. (WIN 45320); Stevenson’s Point, Lac du Bonnet, 16 July 1977, G.M. Keleher 327 (DAO 313272); MacArthur Falls, 10 July 1980, B. Schwie 23 (WIN 38573); Black River at Highway 304, 11 July 1993, E. & D. Punter s.n. (WIN 55023*); Friedensfeld, 5 August 1977, J. Looman 21970 (SASK 123209); Tolstoi, NW3-1-6E, 9 August 1996, L. Reeves s.n. (WIN 59723); Rosa, 7.75 miles north on Highway 59 from the junction of Highway 59 and PR. 201, 2 August 1996, P. Pohrebniuk 11 (WIN 61022); ditch on north side of Springford Road, 6 August 1983, A. McIlraith s.n. (WIN 40566); entre Otterburne et Klee, 16 August 1958, B. Boivin et al. 12934 (ALTA 73381*); Ridgeville, 16 August 1937, H.M.H & E.T.H s.n. (SASK 83406); Bird Hill Park, 18 August 1980, S.L. Konrad 29 (WIN 38527); Winnipeg, Pipestone Rd. at Mollard Avenue, 12 August 1975, G.M. Keleher 211 (DAO 136597); Oak Hammock Marsh SEC 17SW, 1 August 1974, W. Buchanan & J. Holmes s.n. (DAO 798170); Arnaud, 30 July 1939, J.A. Campbell s.n. (SASK 102245); St. Norbert along railroad, 21 July 1952, A. & D. Love 5645 (DAO 123316); Emerson, Township 1, Range 2, east of principal meridian, 6 August 1957, I.J. Bassett & W.J. Kemp 3477 (DAO 123326); St. James, Daisy Road at Prairie View Rd., 25 July 1968, J.M. Walker 5212 (WIN 17426); Stony Mountain, 31 August 1922, H. Groh s.n. (DAO 123303); Deer Lodge, Winnipeg, 9 August 1928, R.F. Peterson s.n. (DAO 123324); Teulon, 29 July 1928, R.F. Peterson s.n. (DAO 123325); Balmoral, 27 July 1946, A.C. Budd & W.A.H. 49 (SASK 102251); Rossler, 20 July 1922, H. Groh s.n. (DAO 123312); Narcisse Wildlife Management Area, 30 July 1998, T. Ruta & M. Kowalchuk 342 (WIN 69764*); St. Lauren, ? August 1913, S.G. Churchward s.n. (WIN 7712); near St. Ambrose, 16 July 1978, D. Punter 7864 (WIN 70938); Morden, 31 July 1941, E.W. Hart 1941 (ALTA 49396); Playgreen Lake, off north end of Lake Winnipeg, 23–25 July 1948, H.J. Scoggan 4189 (ALTA 4811*); south of Portage-la-Prairie, 14 August 1984, D. Punter s.n. (DAO 464522); Portage la Prairie, ? July 1891, J. Keraduoning s.n. (DAO 123320*); Stephenfield Reservoir, 22 July 1978, G.M. Keleher 454 (DAO 313263); Highway 240, 4 km south of Delta, 14 August 1980, C. Welham 23 (WIN 38572*); Ashern, 100 miles northwest of Winnipeg, 15 July 1951, H.J. Scoggan 9547 (WIN 7726); 25 km north of St. Martin, 8 August 1982, M.J. Shehepanek & A.W. Dugal 4530 (SASK 80412); 3 km northwest of Pilot Mound, 6 August 1995, A. Toomac 25 (WIN 58085); Sidney, 22 August 1946, W.L. Gordon 2218 (DAO 126261); Spruce Woods Provincial Park, 24 July 1985, D. Peterkin 24 (WIN 44439); 1.8 km west of Secondary Highway 351 on Highway 1, along small road between divided highway, 3.8 km west of Sidney, 23 July 1994, H.L. Dickson & D.L. Dickson 6625 (DAO 685811); 5 km north of Glenboro, 22 July 1973, J. Looman 18952 (SASK 102259); south of Campsite, south of Carberry along Highway 258, 24 August 1968, T. Campbell C573 (DAO 618592); 10.7 miles west of Carberry Junction and Highway 1, 3 August 1968, W.N. Churys 980 (ALTA 39466); 10 km south of Carberry, 15 August 1977, J. Looman 22067 (SASK 102261); Shilo Military Reserve, 28 July 1978, G.M. Keleher 493 (DAO 313271); Sainte-Rose-du-Lac, 8 miles au nord, Transition entre 1’ Andropogonetum et le Populetum, 19 July 1955, B. Boivin & T. Mosquin 10991 (DAO 123322); southeast corner of junction of Highway 15 and Highway 302, 1.25 km west of Vivian, Map 62 H/16, UTM 812286, 14 August 2001, A. Kinsel 11 (WIN 67899); north of Toutes Aides, 5 August 1975, J. Looman 21389 (SASK 102262); Aweme, ? August 1910, N. Cridde s.n. (DAO 123313); Cartwright, Lisgar District, 20 August 1946, H.A. Senn & W.L. Gordon 3037 (DAO 123315); CFB Shilo, 28 July 1993, J. Shay 93-101 (WIN 67604); Jack Pine plantations, CFB Shilo, Shilo, 8 August 1986, Geoff Jones s.n. (WIN 54680); east of Douglas, 22 July 1946, A.C. Budd & W.A.H. 3 (SASK 102249); Roseneath, 8 August 1956, N.G. Perret 13553 (SASK 102257); Roseneath School District, 8 August 1956, ? 54 (WIN 49748*); Souris River Valley, 35 km south of Brandon, 6 October 1985, Geoff Jones s.n. (WIN 54679); Brandon, 23 July 1946, H. Marshall 5 (DAO 123309*).