



Agriculture
Canada

The genus *Atriplex* (Chenopodiaceae) in Canada

Monograph No. 31
1983



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Introduction

The genus *Atriplex*, commonly called orache, atriplex, or saltbush, of the family Chenopodiaceae (the goosefoot family), comprises nearly 200 species. The genus has a worldwide distribution, occurring on all continents except Antarctica. Most of the species are halophytes of coastal or inland saline habitats; a few are widespread ruderals of disturbed ground.

In Canada, 22 species are known to occur. Seven of these are undoubtedly introduced: *Atriplex semibaccata* R. Br., *A. rosea* L., *A. laciniata* L., *A. littoralis* L., *A. hortensis* L., *A. heterosperma* Bunge, and *A. oblongifolia* Waldst. & Kit. Two further species are cosmopolitan in their distribution: the highly anthropophilic *A. patula* L. is probably introduced into Canada, whereas *A. prostrata* Boucher ex DC. may consist of both native and introduced populations. The following 10 taxa are indigenous to North America: *A. acadensis* Taschereau, *A. gmelinii* C. A. Meyer, *A. alaskensis* S. Watson, *A. subspicata* (Nutt.) Rydb., *A. suchleyi* (Torrey) Rydb., *A. argentea* Nutt., *A. truncata* (Torrey ex S. Watson) A. Gray, *A. powellii* S. Watson, *A. nuttallii* S. Watson, and *A. canescens* (Pursh) Nutt. subsp. *aptera* (A. Nelson) H. M. Hall & Clements. Of the remaining three native species, *A. glabriuscula* Edmondston and *A. praecox* Hülpfers have an ampho-Atlantic distribution, but too little is known of *A. franktonii* Taschereau to determine its phylogeographic status.

Several of the taxa are widespread and weedy. The most important of these are *A. patula*, *A. prostrata*, *A. hortensis*, *A. rosea*, *A. oblongifolia*, *A. heterosperma*, *A. subspicata*, and *A. argentea*. All species of *Atriplex* growing in Canada are primarily wind-pollinated (anemophilous). Late-summer hay fever, usually attributed to *Chenopodium* spp., is in fact often caused by species of *Atriplex*.

Airborne pollen of *Atriplex* and its role in causing hay fever

Information on the role that different species of *Atriplex* play in causing hay fever is far from complete (Wodehouse 1971). Identifying pollen grains of these wind-pollinated taxa is difficult, because the grains are similar to one another and to those of members of other genera of the Chenopodiaceae such as *Chenopodium*, *Sarcobatus*, and *Suaeda* (Bassett et al. 1978).

Species that are able to produce large amounts of pollen in the late summer months and are abundant enough to cause hay fever in Canada are as follows: Western Canada — *Atriplex subspicata*, *A. nuttallii*, *A. rosea*, *A. argentea*, and *A. gmelinii*; Eastern Canada — *A. subspicata* and *A. littoralis*. None of the other 16 species, including *A. patula* and *A. prostrata*, is abundant enough for their pollen to cause hay fever.

Diagnostic characters

Great difficulties exist in identifying plants of the genus *Atriplex*. This is due to the wide variation that exists within a species in vegetative features and to the fact that specimens are usually collected too early, before the more diagnostic characters of bracteoles and seeds are sufficiently developed. Because of this, existing floras and previous taxonomic treatments have failed to recognize the total number of taxa that are present in Canada. The lack of a complete treatment of the genus for North America is another source of difficulty. Authors are bound by geographic limits, hence the proliferation of regional manuals, floras, and checklists, many of which do not yield comparable names, keys, descriptions, and species ranges. Standley (1916) considered that 8 species occurred in Canada, and Hall and Clements (1923) 12; Fernald (1950) recognized 8 species in Eastern Canada alone and Gleason and Cronquist (1963) 10; Scoggan (1978) concluded that 14 species occurred in Canada.

In this publication we present various aspects of taxonomic and biological data on the species of *Atriplex* that occur in Canada. Recognition of the species is aided by a key, descriptions, and illustrations. Distribution maps are provided for each species; these are based entirely on specimens we have examined. This information will provide an aid in understanding the genus *Atriplex* to botanists, weed specialists, agronomists, naturalists, students, and the interested public.

The genus most often confused with *Atriplex* is *Chenopodium* (lamb's-quarters). Two major diagnostic characters separating these two genera are (1) in *Atriplex* the flowers are usually unisexual, whereas in *Chenopodium* they are perfect; (2) in *Atriplex* the seeds are surrounded by bracteoles, whereas in *Chenopodium* bracteoles are lacking.

Leaves

Leaf size and outline show extreme variation from the base to the apex of the plants (Taschereau 1977b). The most constant and characteristic leaves are those on the central axis in the middle portion of the plant. We call the leaves in this region, about halfway between the base and the terminal inflorescence, "lower leaves." They frequently drop before the bracteoles and seed are mature.

Kranztype venation

Kranztype venation, originally 'Kranztypus' (Moser 1934), is a distinctive dark green reticulate venation, which is seen most clearly when the leaf surface is scraped with a sharp blade. This venation pattern is

readily visible under $12\times$ (Fig. 1). Only eight species of *Atriplex* within our range possess kranztype venation. These fall into four sections: *A. rosea* and *A. laciniata* (Sect. *Sclerocalymma*); *A. semibaccata* (Sect. *Semibaccata*); *A. argentea*, *A. truncata*, and *A. powellii* (Sect. *Obione*); and *A. nuttallii* and *A. canescens* (Sect. *Deserticola*).

Plants with the kranztype venation possess the C_4 dicarboxylic acid pathway of carbon assimilation in photosynthesis (Tregunna et al. 1970; Welkie and Caldwell 1970; Downton 1971; Laetsch 1974; Carolin et al. 1975; Bishop and Reed 1976). Under conditions of high light intensity and high temperatures, this is an efficient photosynthetic mechanism and has led to the use of *Atriplex* spp. as important experimental tools in physiological studies (Jones 1970; Björkman 1971; Björkman et al. 1971; Carnegie Institution 1971).

Bracteoles

Bracteoles of species of *Atriplex* are varied in their morphology. Some are leafy, others are thickened, or cartilaginous. The degree of joining from the base to the apex, the presence or absence and positioning of tubercles, the presence or absence of an inner spongy layer, the venation, the presence or absence of a lateral angle (Fig. 2), and a footstalk (peduncle) all aid in the understanding and recognition of the various species. Spongy air-filled parenchyma may develop only at the base of the bracteoles or may line the entire inner surface.

Flowers

The flowers of species of *Atriplex* are normally unisexual. Some species are dioecious, i.e., the male and female flowers are on different plants, but most species found in Canada are monoecious, i.e., the male and female flowers are on the same plant and indeed often on the same spike. The male flowers have a four- or five-cleft perianth, but in almost all species the female flowers lack a perianth and the ovary is naked within the pair of bracteoles. A few species (e.g., *A. suckleyi* in Sect. *Endolepis*) do have a perianth in the female flowers, and in one species, *A. hortensis* (Sect. *Atriplex*), the female flowers are dimorphic: some are perianth-bearing and in these a horizontal seed is developed. Others lack any perianth and have a vertical seed enclosed by the bracteoles, as in most other species.

Pollen size

Pollen diameter is reported for most species; the ranges and means given are based on measurements of at least 20 grains from plants.

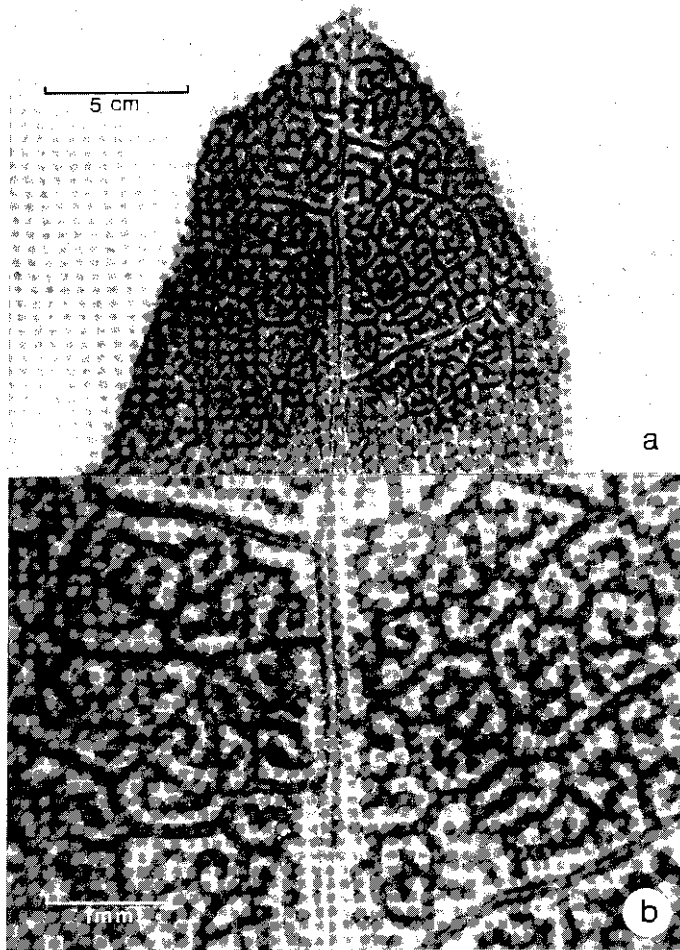


Fig. 1. *Atriplex laciniata*, leaf scraped with a razor blade to expose kranztype venation: *a*, $\times 12$; *b*, $\times 40$.

Seed types

Some species of *Atriplex* exhibit seed dimorphism. On the same plant two distinct types of seed are produced, large brown ones and small black ones. The large brown seeds are reddish brown to dark brown, flattened and disk shaped, have a prominent radicle, a dull or pebbly glossy surface with the radicle striate-pebbly, and a soft outer pericarp. The small black seeds are biconvex, and have an obscure radicle and a glossy surface. In addition, intermediate types may occur. The relative abundance of large brown, small black, and intermediate seed types is frequently a useful taxonomic character (Taschereau 1972).

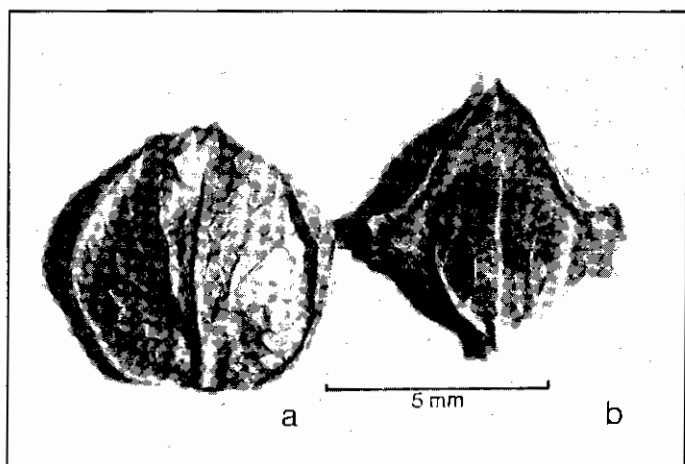


Fig. 2. *a*, *Atriplex oblongifolia*, bracteole circular in outline; *b*, *Atriplex patula*, bracteole having lateral angle.

The position of the seed within the pericarp is also of taxonomic importance in *Atriplex*. When the seed is erect the radicle arises toward the base of the seed and is said to be *inferior* to the plumule; this is characteristic of the largely coastal species that make up Sect. *Teutliopsis*. In other species, e.g., those of the *Obione* group, the seed is inverted and the radicle is said to be *superior* to the plumule and visible toward the top of the seed.

In those species with an inferior radicle, the position of apparent emergence and the direction in which the tip of the radicle points are features that are also used as a taxonomic character.

The distinctions in radicle position and direction, as well as differences in seed shape, are much more apparent in the large brown and intermediate types than in the small black types.

Surrounding the seed is a loosely or firmly attached membranous pericarp with the vestiges of the style situated at the top. The outline of the radicle becomes visible on the seed margin when the lower part of the pericarp is teased away. The radicle may emerge from the middle portion of the seed margin, when it is said to be *median*, or from the base of the seed (*basal*). The radicle apex may be directed upward toward the style vestiges, a condition called *uppointing* (or ascending) (Fig. 24), outward at right angles to the style axis, a condition called *outpointing* (Fig. 7), or at an angle between these directions, a condition called *obliquely uppointing* (or subascending) (Fig. 14).

Other diagnostic characteristics used in the identification key and in the descriptions of the taxa are explained in the glossary.

Chromosome numbers

Chromosome counts are given for each species occurring in Canada. Counts were made using the alcoholic hydrochloric acid-carmines staining technique devised by Snow (1963). The base number in *Atriplex* is almost certainly $x = 9$. Frankton and Bassett (1968, 1970), Bassett (1969), Bassett and Crompton (1970, 1971a, 1971b, 1973), Crompton and Bassett (1975), Taschereau (1972), Gustafsson (1972, 1973, 1974, 1976), Jones (1975), and Nobs (1975) have determined $n = 9$, $2n = 18$; $n = 18$, $2n = 36$; $n = 27$, $2n = 54$ in species included in this study. However, on the basis of counts on plants from the Netherlands, chromosome base numbers of $x = 8$ and $x = 9$ have been claimed for *A. prostrata* (Gadella and Kliphuis 1968). Care must be exercised in determining the chromosome complement in members of this genus because, as previously stated, the identification of taxa is difficult and polysomaty (Löve and Löve 1975) occurs in the somatic tissue of many root tips. We recommend that counts be made on material grown in a greenhouse or nursery until mature enough for positive identification, and that polyploid counts obtained from root tips be confirmed by meiotic (pollen mother cell) squash preparations. Herbarium voucher specimens of our chromosome material are preserved in the Vascular Plant Herbarium (DAO) of the Biosystematics Research Institute, Agriculture Canada, Ottawa, Ontario.

Hybrids

Individual species in the genus *Atriplex* are so variable that reporting putative hybrids without supporting evidence from experimental data has little value. This is well-illustrated by the past treatment of the *A. patula* group in North America. Most authors since Gray (1868) have been content to treat *A. littoralis*, *A. prostrata* (*A. hastata*), and *A. glabriuscula* as intergrading varieties of a single species — *A. patula*. Cytological studies and experimental hybridization followed by field and herbarium studies now indicate that these “confluent vars.,” as Fernald (1950) called them, rarely hybridize and that hybrids between these taxa in North America are unknown. *A. patula* is a tetraploid and the other species are diploids. Partly because these species were assumed to hybridize, the name *A. patula* var. *littoralis*, for example, has been applied not only to narrow-leaved forms of *A. patula* s.str. but also to the hexaploid species *A. subspicata* and the introduced European diploid *A. littoralis* (Taschereau 1972).

Turesson (1925) provided the first experimental data on hybrids in the genus *Atriplex*, and Hulme (1957, 1958) made the first carefully controlled hybrid crosses. Since then Gustafsson (1973, 1974, 1976) has performed many experimental crosses and demonstrated the occurrence of numerous hybrids and hybrid derivatives in nature. Turesson and

Gustafsson worked with plants of Scandinavian origin, and Hulme worked with plants from Britain. Nobs (1976) has performed experimental crosses involving plants from North America. Seven of the species he utilized occur in Canada but none of the F_1 hybrids from crosses within this group produced stable offspring; and Nobs gives no indication that any of these hybrids occur in nature. Taschereau (1977b, 1978a, 1978b, 1980, 1981) has been doing similar experimental hybridization work and mapping the distribution of hybrids in the British Isles. The occurrence and distribution of hybrids in Canada, however, is yet to be resolved.

Despite the lack of experimental data on Canadian plants, data from other sources indicate that the following hybrids may be expected:

1. Hybrids between taxa in the *A. prostrata* group. This group comprises a number of partially interfertile and morphologically similar taxa found on the coasts of eastern North America, western Europe, and elsewhere. In Canada it is represented by the following species: *A. prostrata*, *A. glabriuscula*, *A. franktonii*, and *A. praecox*. Hybrids between some members of this group occur in Scandinavia (Gustafsson 1976), and some are widespread in the British Isles (Taschereau 1980).

2. *A. acadiensis* \times *A. glabriuscula*. In the Botanic Garden at Manchester, England, *A. acadiensis* formed spontaneous hybrids with plants of *A. glabriuscula*, both from Nova Scotia and from England. These presumably sterile triploid hybrids exhibited marked heterosis, being much more vigorous than adjacent self-sown plants of the parent species.

3. *A. oblongifolia* \times *A. patula*. Abundant, very fertile, but apparently hybrid plants ($2n = 36$, Taschereau 1980) occurred spontaneously in the Manchester University Botanic Garden where the parent species had been grown the previous year. Aellen (1960) stated that this was the most commonly reported *Atriplex* hybrid and that it occurred wherever the alien *A. oblongifolia* invaded the range of *A. patula* in central Europe. However, the similarity of the parents is such that until the hybrid is synthesized under conditions of controlled emasculation, the identity of these putative hybrids must remain uncertain.

The identification of hybrids is difficult. Low pollen fertility and seed set may suggest hybridization, but non-hybrid populations can have many individuals with very low pollen fertility (Gustafsson 1972), and non-hybrid plants whose bracteoles are mostly or entirely empty are often encountered in the field (Taschereau 1981). Chromosome counts, especially of suspected triploid hybrids, are useful but often impractical.

Direct comparison with many experimentally produced hybrids is the most satisfactory method of identifying suspected hybrid plants. The largest collections of voucher specimens of experimentally produced crosses between species that occur in Canada are those of Gustafsson housed at LD and of Taschereau at MANCH.

All the species examined to date are self-compatible. Autogamy is frequent in this group and where the plants are isolated, this leads to the formation and perpetuation of numerous more or less distinct biotypes. Outcrossing is sufficiently frequent that infraspecific character combinations are inconsistent and many bracteole leaf and habit characters that have been used to distinguish infraspecific taxa show continuous variation.

Nomenclature

In the past, different scientific names have been applied to the same taxon by various authors. According to the *International code of botanical nomenclature* (Stafleu et al. 1978), the correct name for any taxon is the earliest name that is published in accordance with the rules; other names are synonyms. For the taxa included in this publication, many different names are found in the literature. We have attempted to list all those names that are encountered in the more commonly used floras and manuals, and in recent research publications.

Herbaria examined

The herbaria from which specimens were examined are listed below. The abbreviations are those listed in the sixth edition of *Index herbariorum* (Holmgren and Keuken 1974).

CANADA: University of British Columbia, Vancouver, B.C. (UBC); British Columbia Provincial Museum, Victoria, B.C. (V); University of Alberta, Edmonton, Alta. (ALTA); University of Saskatchewan, Saskatoon, Sask. (SASK); Agriculture Canada, Swift Current, Sask. (SCS); University of Manitoba, Winnipeg, Man. (WIN); Lakehead University, Thunder Bay, Ont. (LKHD); University of Toronto, Toronto, Ont. (TRT); University of Guelph, Guelph, Ont. (OAC); National Museum of Canada, Ottawa, Ont. (CAN); Biosystematics Research Institute, Ottawa, Ont. (DAO); Queen's University, Kingston, Ont. (QK); Université de Montréal, Que. (MT); McGill University, Montreal, Que. (MTMG); University of New Brunswick, Fredericton, N.B. (UNB); Dalhousie University, Halifax, N.S. (DAL); Acadia University, Wolfville, N.S. (ACAD).

USA: The New York Botanical Garden, New York, (NY); The Gray Herbarium of Harvard University, Cambridge, Mass. (GH); U.S. National Herbarium, Washington, D.C. (US); U.S. National Arboretum, Washington, D.C. (NA); Academy of Natural Sciences, Philadelphia, Penn. (PH); University of Utah, Salt Lake City, (UT); University of California, Berkeley, (UC); University of Washington, Seattle, (WTU).

EUROPE: FRANCE: Museum National d'Histoire Naturelle, Paris, (P) (exp. Haller's herbarium: P-HA). SWEDEN: Botaniska Museet, Lund, (LD); Naturhistoriska Riksmuseet, Stockholm, (S). U.K.: British Museum, London, (BM); Royal Botanic Gardens, Kew, (K); The Linnean Society of London, (LINN); The Manchester Museum, Manchester, (MANCH); South London Botanical Institute (SLBI). USSR: Botanical Institute of the Academy of Sciences, Leningrad, (LE).

Acknowledgments

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Atriplex: generic description, species relationships in *Atriplex*, and infra-generic classification

Generic description

Atriplex L., Sp. Pl. 1052. 1753; Gen. Pl. ed. 5. 472. 1754.

Syn.: *Obione* Gaertner, De Fruct. Sem. Pl. 2: 198. 1971. (Type: *O. muricata* Gaertner, nom. illegit. = *A. sibirica* L.)

Endolepis Torrey, in A. Gray, Rep. Explor. Railroad Pac. Ocean 12(2):47. 1860. (Type: *E. suckleyi* Torrey.)

Annual or perennial, monoecious or dioecious herbs or shrubs; more or less scurfy, farinose or furfuraceous with vesicular hairs. Leaves opposite or alternate, sessile or petioled, entire, serrate or lobed; venation of the kranztype (kranztypus) or normal dicotyledonous type. Flowers unisexual, solitary or glomerulate in the leaf axils or in terminal spikes or panicles; staminate and pistillate flowers in the same glomerule or the staminate superior. Staminate flowers ebracteolate, with a 3-5-parted perianth, segments obovate or oblong, obtuse; stamens 3-5, inserted at the base of the perianth; filaments distinct or connate at the base; anthers 2-celled; ovary rudimentary or wanting. Pistillate flowers each 2-bracteolate, the bracteoles accrescent, distinct or usually united at the base and enclosing the fruit, herbaceous, spongy or cartilaginous, entire or

toothed, dorsal surface smooth or variously appendaged; perianth usually absent, sometimes a 3–5-lobed membranous calyx, rarely of 1–5 squamellae; stamens wanting; ovary ovoid or depressed-globose; stigmas 2, sub-filiform, thickened or compressed toward the connate bases; the ovule either oblique or erect on a short funiculus or inverted and suspended from an elongated funiculus; utricle with a membranous pericarp usually free from the seed. Seeds usually vertical, homomorphic or heteromorphic (small black or large brown), erect or inverted, rarely horizontal (in perianth-bearing flowers); seed coat membranous, coriaceous or subcrustaceous; embryo annular around the farinaceous perisperm; radicle inferior, lateral or superior.

Lectotype: A. hortensis L.

Species relationships in *Atriplex*

We accept the broad circumscription of *Atriplex* adopted, for example, by Hall and Clements (1923) and to some extent by Standley (1916). Other authors recognize both *Endolepis* Torrey and *Obione* Gaertner as separate genera, the former characterized by a crested perianth on the male flowers and by the presence of a simple perianth on the female flowers, and the latter by the superior radicle. As Hall and Clements (1923) show, intermediate conditions and various other character combinations (e.g., a perianth in some female flowers of *A. hortensis*, the type species of *Atriplex*) exist, making segregation of these genera unwarranted without further evidence.

Natural groupings of the species can be recognized, however, and the species represented in Canada can be arranged in seven sections, as outlined below. One of the sections corresponds to the genus *Endolepis* and two others (*Obione* and *Deserticola*) would fall within the genus *Obione* as this is usually circumscribed.

Infra-generic classification

I. Sect. *Atriplex*

Syn.: *Atriplex* Sect. *Dichospermum* Dumort., Fl. Belg. 21. 1827. *Lectotype: A. hortensis* L.

A. I. *Hortenses* Standley, N. Am. Flora 21:39. 1916. *Lectotype: A. hortensis* L.

Erect annuals. Leaves lacking kranztype venation. Moneocious. Pistillate flowers of two kinds: some ebracteolate with a regular 3–5-lobed perianth developing a horizontal seed; the others without a perianth but enclosed by a pair of bracteoles and developing a vertical seed. Bracteoles

ovate to orbicular, free nearly to the base. Vertical seed erect, the radicle inferior, basal.

1. *A. hortensis*

II. Sect. **Teutliopsis** Dumort., Fl. Belg. 20. 1827. *Lectotype*: *A. hastata* L.
Syn.: *A. II. Hastatae* Standley, N. Am. Flora 21:40. 1916. *Lectotype*: *A. hastata* L.

Erect to procumbent annuals. Leaves lacking kranztype venation. Monoecious. Pistillate flowers always lacking a perianth but enclosed by a pair of bracteoles. Bracteoles linear to deltoid, free almost to the base. Seeds all vertical, the radicle inferior, basal, or median.

2. *A. heterosperma*

8. *A. subspicata*

3. *A. oblongifolia*

9. *A. littoralis*

4. *A. patula*

10. *A. prostrata*

5. *A. acadensis*

11. *A. glabriuscula*

6. *A. gmelinii*

12. *A. franktonii*

7. *A. alaskensis*

13. *A. praecox*

III. Sect. **Sclerocalymma** (Ascherson) Ascherson & Graebner, Syn. Fl. Mitt.-Eur. 5(4):139. 1913. (cf. p. 114).

Syn.: *A. b. Sclerocalymma* Ascherson, Fl. Prov. Brandenburg 1:578. 1864. *Type*: *A. rosea*.

A. III. Roseae Standley, N. Am. Flora 21:63. 1916.

Erect to decumbent annuals. Leaves with kranztype venation. Monoecious. Pistillate flowers always lacking a perianth but enclosed by a pair of bracteoles. Bracteoles rhombic to ovate, united to about the middle, the lower part hardened and cartilaginous in fruit. Seeds all vertical, the radicle inferior, basal, or median.

14. *A. rosea*

15. *A. laciniata*

IV. Sect. **Endolepis** (Torrey) McNeill

Syn.: *Endolepis* Torrey, in A. Gray, Rep. Explor. Railroad Pac. Ocean 12 (2):47. 1860. *Type*: *E. suckleyi* Torrey.

Spreading annuals. Leaves without kranztype venation. Monoecious. Staminate flowers often with crested perianth segments; pistillate flowers with a 3- to 4-lobed perianth and enclosed in a pair of bracteoles. Bracteoles ovate, united at least to the middle, often to the apex. Seeds all vertical, the radicle superior.

16. *A. suckleyi*

V. Sect. **Semibaccata** Ulbrich, in Engler and Prantl, Nat. Pflanzenfam. ed. 2, 16c:515. 1934. *Lectotype*: *A. semibaccata* R.Br.

Syn.: A. XIII. *Semibaccatae* Standley, N. Am. Flora 21:52. 1916.
Type: *A. semibaccata*.

Prostrate perennials, woody at the base. Leaves with kranztype venation. Monoecious. Pistillate flowers without any perianth but enclosed by a pair of bracteoles. Bracteoles fleshy, united only at the base. Seeds all vertical, the radical inferior, lateral.

17. *A. semibaccata*

VI. Sect. **Obione** (Gaertner) C. A. Meyer, in Ledeb., Fl. Altaica 4:315. 1833.

Syn.: *Obione* Gaertner, De Fruct. Sem. Pl. 2:198. 1791. *Type*: *O. muriculata* Gaertner, nom. illegit. (= *A. siberica* L.).

O. Sect. Atriplicina Moq., Chenopod. Enum. 70. 1840, (nom. illegit. = Sect. *Obione*).

A. VIII. *Argenteae* Standley, N. Am. Flora 21:46. 1916. *Lectotype*: *A. argentea* Nutt.

A. IX. *Powellianae* Standley, N. Am. Flora 21:48. 1916. *Lectotype*: *A. powellii* S. Watson.

A. X. *Truncatae* Standley, N. Am. Flora 21:49. 1916. *Lectotype*: *A. truncata* (Torrey) A. Gray.

Erect, densely furfuraceous annuals. Leaves with kranztype venation. Monoecious. Pistillate flowers always lacking perianth. Bracteoles cuneate to obovate, usually broadest above the middle, united at least to the middle, sometimes tuberculate or cristate.

18. *A. argentea*

20. *A. powellii*

19. *A. truncata*

VII. Sect. **Deserticola** (Ulbrich) McNeill et al.

Syn.: *Pterochiton* Torrey & Fremont, in Fremont, Rep. Exped. Rocky Mt. 318. 1845. *Type*: *P. occidentale* Torrey & Fremont (= *A. canescens* (Pursh) Nutt.).

A. XXVI. *Nuttallianae* Standley, in N. Am. Flora 21:66. 1916. *Lectotype*: *A. nuttallii* S. Watson.

A. XXVIII. *Confertifoliae* Standley, in N. Am. Flora 21:70. 1916. *Lectotype*: *A. confertifolia* (Torrey) S. Watson.

A. XXIX. *Canescentes* Standley, in N. Am. Flora 21:70. 1916. *Lectotype*: *A. canescens* (Pursh) Nutt.

Obione Sect. *Deserticola* Ulbrich, in Engler and Prantl, Nat. Pflanzenfam. ed. 2, 16c:508. 1934. *Lectotype*: *A. confertifolia* (Torrey) S. Watson.

Obione Subgenus *Pterochiton* (Torrey & Fremont) Ulbrich, in Engler and Prantl, Nat. Pflanzenfam. ed. 2, 16c:509. 1934.

Low to tall shrubs. Leaves with kranztype venation. Dioecious. Pistillate flowers lacking any perianth. Bracteoles ovate-orbicular, united at least to the middle, usually tuberculate or winged. Seeds vertical, the radicle superior.

21. *A. nuttallii*

22. *A. canescens*

Key to the species (for use with mature plants only)

1. Perennial shrubs with kranztype leaf venation (appearing at 12× as a conspicuous dark green reticulum when scraped lightly with a sharp blade (Fig. 12))
 2. Dioecious; leaves entire
 3. Bracteoles irregular in shape, lacking tubercles but with 4 projecting lateral wings. 22. *A. canescens*
 3. Bracteoles globose, with tubercles but without wings 21. *A. nuttallii*
 2. Monoecious; leaves entire to repand-dentate 17. *A. semibaccata*
1. Annual herbs with either kranztype leaf venation or normal dicotyledonous venation
 4. Leaf venation kranztype
 5. Leaves commonly entire, whitish gray; plants erect; branches ascending; radicle superior; alkaline habitats in Western Canada
 6. Bracteoles obovate, 4–8 mm long, deeply dentate 18. *A. argentea*
 6. Bracteoles cuneate or oblong, 2.0–3.5 mm long, usually entire, never dentate
 7. Bracteoles cuneate, with 3 minute teeth at the apex; dorsal surface smooth or sometimes with 1 or 2 small tubercles; leaves not conspicuously nerved 19. *A. truncata*
 7. Bracteoles oblong, crowned with a flattened lobe; dorsal surface usually with numerous small tubercles below the lobes; leaves conspicuously 3-nerved 20. *A. powellii*
 5. Leaves commonly sinuate-dentate and lobed, grayish green; plants decumbent or erect; branches ascending to spreading; radicle inferior; coastal or inland habitats in Eastern and Western Canada
 8. Seeds 3.5–4.0 mm wide; plants decumbent; rare coastal halophyte restricted to sandy beaches bordering the Gulf of St. Lawrence 15. *A. laciniata*
 8. Seeds 2.0–2.5 mm wide; plants erect; common inland weed in parts of Western Canada and occurring infrequently in southern Ontario. 14. *A. rosea*
 4. Leaf venation the normal dicotyledonous type
 9. Perianth of staminate flowers cup-shaped, the lobes fleshy-crested on the back, pink; bracteole margins united up to the apex 16. *A. suckleyi*
 9. Perianth of staminate flowers with the lobes ovate, rounded on the back, green in the center, becoming membranous toward the margins; bracteole margins united at the base or up to the middle

10. Bracteoles herbaceous or membranous throughout; no spongy inner tissue present
 11. Plants 12 cm high or less; lower leaves lanceolate to rhombic-ovate, cuneate to attenuate at base; bracteoles rhombic-ovate, thin-herbaceous or membranous, entire, free to the base; seeds black, lustrous, biconvex, 1.2–2.5 mm wide with a sub-basal outpointing radicle; restricted to the sublittoral zone on coasts of Eastern Canada 13. *A. praecox*
 11. Plants more than 12 cm high; lower leaves, bracteoles, and seeds various but not as in the above combination; widespread in various habitats
 12. Bracteoles orbicular, always entire, lacking lateral angles
 13. Horizontal seeds, surrounded by a persistent perianth, present among the more abundant vertical seeds, enclosed by bracteoles; bracteoles subcordate or broadly rounded at the base 1. *A. hortensis*
 13. Horizontal seeds absent; seeds all vertical, enclosed by bracteoles; bracteoles shortly attenuate at the base with veins merging only at the base... 2. *A. heterosperma*
 12. Bracteoles never orbicular, frequently toothed and usually with lateral angles
 14. Largest bracteoles ovate, ovate-triangular or rhombic; eastern coastal halophytes or widespread ruderals
 15. Radicle of brown seeds basal and outpointing; restricted to East Coast salt marsh habitats 5. *A. acadensis*
 15. Radicle of brown seeds subbasal to median and uppointing; widespread ruderals
 16. Bracteoles rhombic with margins united almost to the middle and lateral angles clearly developed; terminal inflorescence of densely compressed more or less uniform-sized bracteoles; upper leaves green above and below... 4. *A. patula*
 16. Bracteoles ovate or triangular-ovate with margins free to the base and lateral angles absent; terminal inflorescence of loosely spaced larger and smaller bracteoles; upper leaves whitish below 3. *A. oblongifolia*
 14. Largest bracteoles strap-shaped or ovate-lanceolate; western coastal halophytes
 17. Brown seeds 1.7–2.7 mm wide ... 6. *A. gmelinii*
 17. Brown seeds 2.8–3.7 mm wide ... 7. *A. alaskensis*
10. Bracteoles more or less thickened especially toward the base by the presence of spongy inner tissue
 18. Lower leaves triangular
 19. Some axillary bracteoles stalked; margins of all bracteoles irregularly denticulate to lacinate, the lateral angles usually developed into 1–3 short or long teeth 12. *A. franktonii*
 19. Bracteoles all sessile, the margins entire or slightly toothed, the lateral angles short-pointed but not clearly developed into teeth

20. Inflorescence with leafy bracts to the tip, glomerules loose, irregularly spaced; bracteoles thick and spongy, margins united up to the middle; seeds more than 2.5 mm wide, usually not distinctly dimorphic, dark brown to black, irregularly biconvex; radicle median and more or less strongly uppointing 11. *A. glabriuscula*
20. Inflorescence with leafy bracts only at the base, glomerules tight, contiguous or irregularly spaced; bracteoles thin to slightly thickened and spongy, margins united only at the base; seeds mostly less than 2.5 mm wide, usually distinctly dimorphic, mostly small glossy-black but also some larger, dull brown, flattened and disc-shaped; radicle subbasal, obliquely uppointing to outpointing 10. *A. prostrata*
18. Lower leaves linear or ovate-lanceolate
21. Leaves linear; seeds ovoid, not wider than long 9. *A. littoralis*
21. Leaves ovate-lanceolate or linear; seeds ellipsoidal, wider than long 8. *A. subspicata*

Species descriptions, distributions, notes, and illustrations

1. *Atriplex hortensis* L., Sp. Pl. 1053. 1753.

Lectotype: Sheet No. 1 marked "*Atriplex hortensis*" in Hortus Siccus Cliffortianus (BM! photograph DAO!).

Common names. Garden atriplex, garden scale, garden orach(e), mountain spinach.

Annual, 150–210 cm high, exceptionally to 36 dm, erect or often half-decumbent, widely branched from the base. Leaves lacking the kranztype venation, alternate in the upper part of the stem, to at least 8 cm long and 7 cm wide in well-developed plants, triangular or ovate-triangular with a hastate base, almost entire or with irregularly spaced teeth, mealy at first, but later glabrous and green on both surfaces; petioles up to 3 cm long. Flowers in a terminal or axillary inflorescence that becomes elongated and thick from the masses of large bracteoles. Monoecious; male flowers with a 5-parted perianth; female flowers dimorphic: some ebracteolate with a 5-parted perianth but most without a perianth but with 2 bracteoles. Bracteoles orbicular, veins merging above the base, varying in size, most 10–15 mm in length when mature but some much smaller and not exceeding 5 mm; seeds of the perianth-bearing flowers horizontal, biconvex, black, shiny, about 2 mm wide, those of the bracteolate flowers vertical; the vertical seeds contained by the very small bracteoles, black, similar to those of the perianth-bearing flowers, but those contained by the larger bracteoles flat, dull, yellowish brown, about

4 mm wide; seeds of both kinds with a membranous easily removed pericarp; radicle inferior and basal. Pollen grains periporate, averaging 22 μm (19–25 μm) in diameter.

Chromosome number. $2n = 18$ (Frankton and Bassett 1968; Nobs 1975).

Distribution. Introduced to North America, *A. hortensis* is now widespread, particularly in the West where in some areas, such as southern Saskatchewan, it has become abundant about towns and villages. Distribution in Canada is shown in Fig. 3. *A. hortensis* flowers from mid-July and frequently bears mature seed by the end of August. Most authors consider it to have originated in Asia. It is now a naturalized plant throughout central and southern Europe following its cultivation as a garden vegetable. The plant has a number of uses: reddish-colored variants are sometimes grown for ornamental purposes; the foliage, rich in vitamin C, is cooked and eaten like spinach; in the USSR a blue dye is extracted from the seeds.

2. *Atriplex heterosperma* Bunge, Beitr. Fl. Russl. (Reliq. Lehm.). 272. 1852.

Type: "An salzhaltigen Flecken in der nördlichen Steppe zwischen Busuluk und Uralsk." 29 Aug. 1940 (fruct.). *A. Lehmann.* holo: ?P. (? LE).

Common name. Russian atriplex.

Annual, up to 150 cm high, stiffly erect, branching from the base. Leaves whitish mealy on the lower surface when young, becoming uniformly green on both surfaces when older, lacking kranztype venation, alternate in the upper part of the plant but the first-formed leaves opposite, young plants thus appearing to have only opposite leaves; leaf blades as wide as long, those of the stem averaging 6.5 cm long, the basal much longer, triangular and hastate or slightly cuneate at the base; base of the leaf often with a pair of small downward-pointing auricles; petioles 2–3 cm long. Monoecious; flowers in loosely bunched terminal and axillary inflorescences; male flowers with a 5-parted perianth and usually with 5 stamens; female flowers without a perianth but with 2 bracteoles. Bracteoles free to base, rounded, smooth and without appendages, the veins meeting at the base; bracteoles of two sizes: large, 5–6 mm long and about 5 mm wide and only partially occupied by a flat, dull, yellowish brown seed, 2–3 mm wide; and small, 2 mm long and nearly as wide, almost completely occupied by a biconvex, shiny, black seed 1.5 mm or less wide. Seeds vertical within a membranous pericarp; radicle inferior and basal. Pollen grains periporate, 26 μm (25–27 μm) in diameter.

Chromosome number. $2n = 36$ (Frankton and Bassett 1968; Nobs 1975).

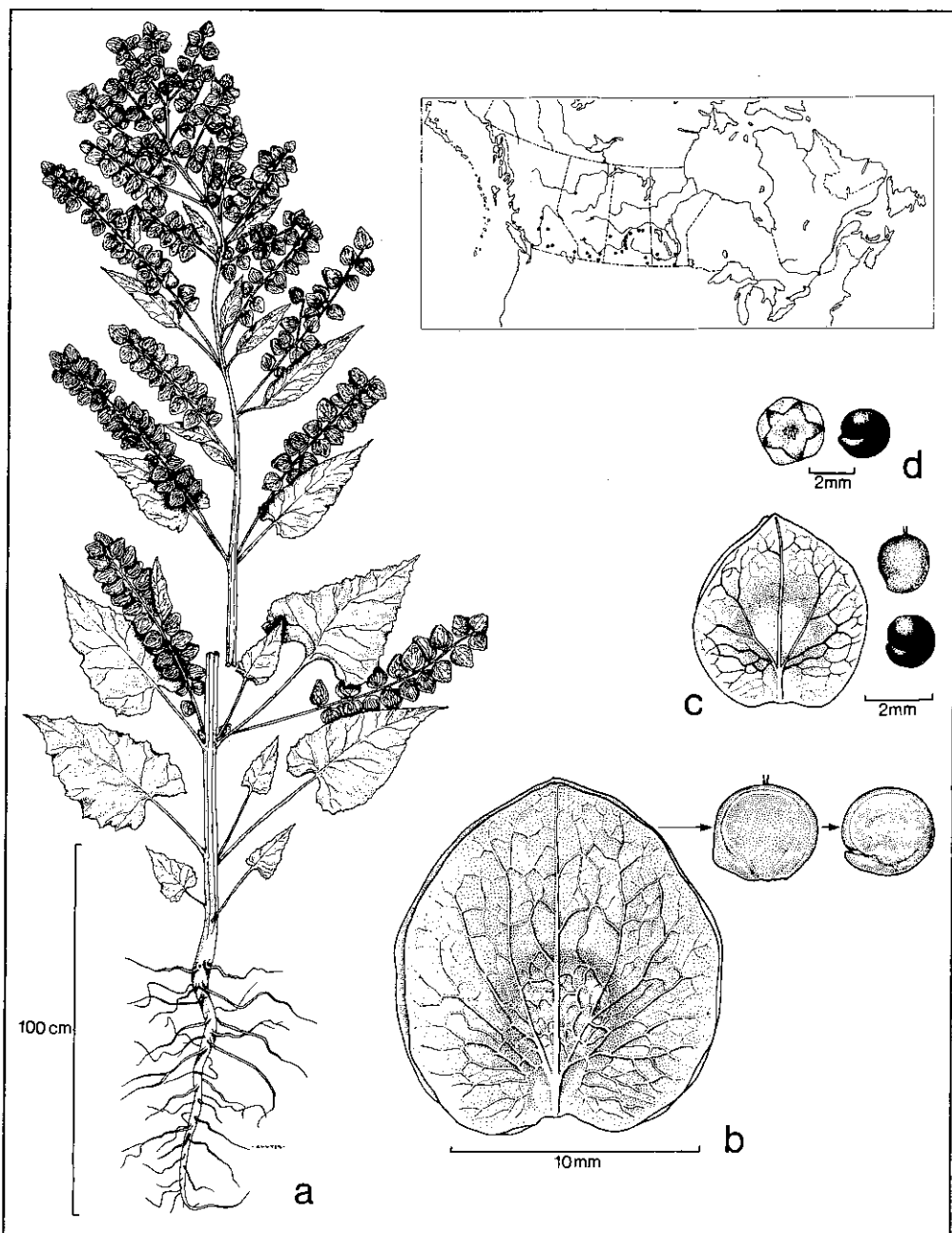


Fig. 3. *Atriplex hortensis*: a, plant; b, large bracteole, having large brown flattened seeds; c and d, dimorphic bracteoles, upper type produces rounded dark seeds, lower type produces small flattened brown seeds and rounded black seeds.

Distribution. *Atriplex heterosperma* is particularly abundant in the Okanagan Valley, B.C.; here and elsewhere in that province large weedy patches occur along roadsides and in waste places. From recent collecting and examination of herbarium material the species is found to occur also in Alberta, Manitoba, Ontario, and Quebec (Fig. 4). In the USA it is known in the states of California, North Dakota, Montana, Colorado, and Washington. According to Nobs (1975), *A. heterosperma* is frequent on saline soils in the Great Valley, CA, and on the east side of the Sierra Nevada from Merced and Inyo counties. *Atriplex heterosperma* occurs widely in Europe as an introduced ruderal. It is native in parts of European and Asiatic USSR and in Chinese Turkestan.

Flowering begins in early August; the bracteoles containing the smaller black seeds are mature by early September, but the less numerous bracteoles with large brown seeds develop later and do not mature until mid-October.

3. *Atriplex oblongifolia* Waldst. & Kit., Pl. Rar. Hung. 3:278. 1812.

Type: "Budae ad pedem montis Gerhardi infra thermas Gerhardianus, alibique inter vineas, atque ad margines & saepes vinearum" ([Hungary:] Buda [part of Budapest], at the foot of Mt. Gerhard below the Gerhardian warm springs, and elsewhere in vineyards and at margins & hedges of vineyards"). ?*Kitabel*. Holo. ?PR.

Annual, up to 120 cm high, erect, branching from the base. Leaves lacking kranztype venation, alternate except at the base of the stem, ovate-lanceolate, up to 7 cm long and 2.5 cm wide, widest near the base, entire or with few teeth, tapering to the apex and cuneate at base, lower surface mealy and thus paler than the upper surface, this mealiness persisting at least on the upper leaves; petioles about 1 cm long. Monoecious; flowers loosely arranged in terminal or axillary inflorescences that elongate at maturity; all female flowers without a perianth but with 2 bracteoles that are free to the base. Bracteoles ovoid-rhombic or triangular-ovate, thin, entire, without appendages and essentially smooth on the back, although occasionally roughened when immature; larger bracteoles up to 13 mm long, each partially occupied by a flat, dull yellowish brown seed that is about 3 mm wide and long; smaller bracteoles containing black shiny seeds, 1.5 mm wide. All seeds with vertical attachment and an easily removed membranous pericarp; radicle inferior and basal. Pollen grains periporate, 25 μm (24–27 μm) in diameter.

Chromosome number. $n = 18$ (Bassett and Crompton 1971a).

Distribution. *A. oblongifolia* occurs in southern British Columbia, Alberta, and at Ivy Lea, Ontario (Bassett and Spicer 1970). Specimens have also been seen from Washington and South Dakota in the United

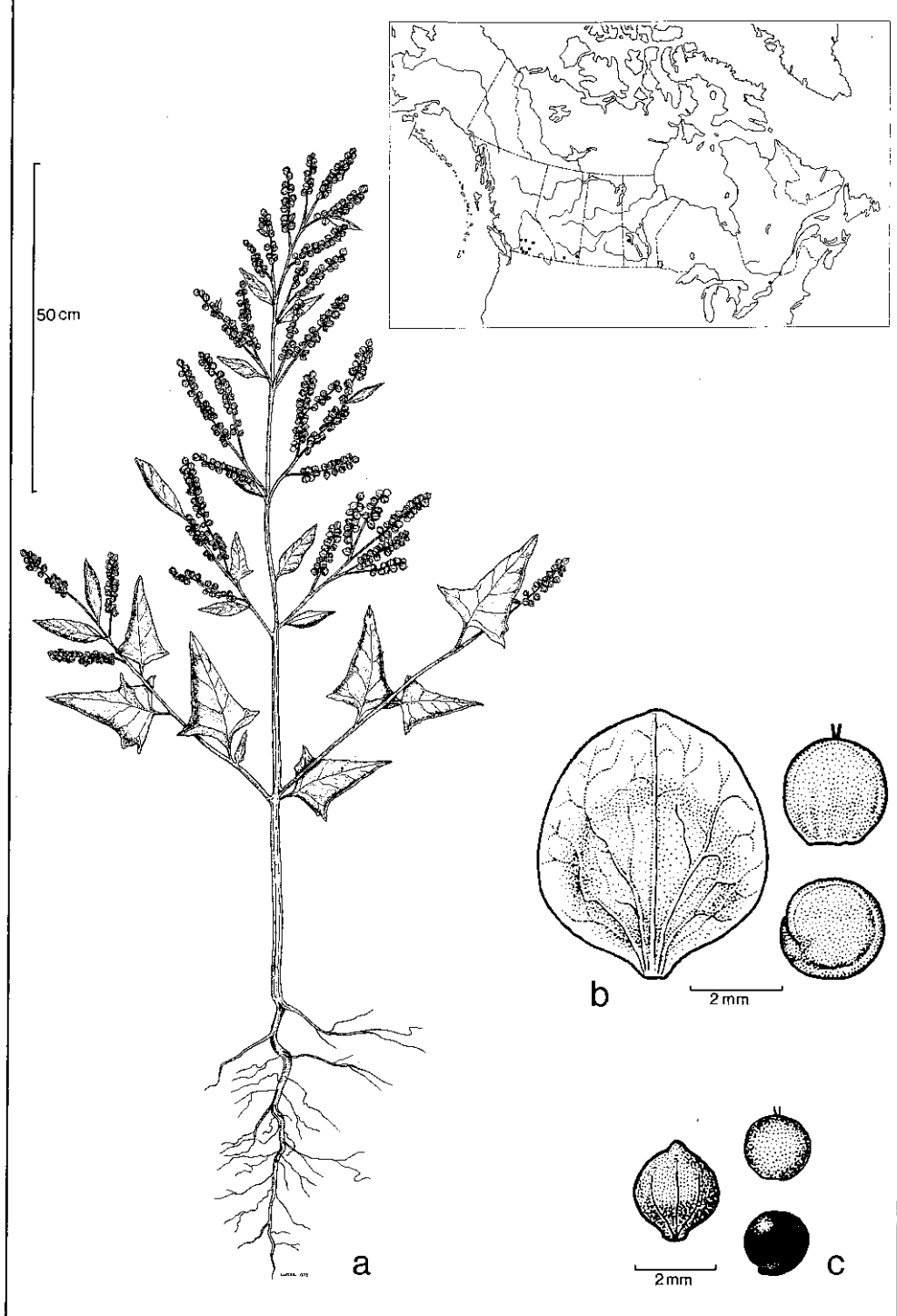


Fig. 4. *Atriplex heterosperma*: a, plant; b and c, bracteoles with corresponding seed types.

States. *Atriplex oblongifolia* occurs in central, eastern, and southeastern Europe, North Africa, and Southwest Asia, eastward to central Asiatic USSR. It is weedy in many habitats.

From our few specimens it appears that flowering begins in early August and the seeds probably mature by the end of September. The bracteole characters and the abundant mealiness on the lower leaf surfaces usually allow ready recognition of this species. It may be more weedy and abundant in North America than existing records suggest (Fig. 5).

4. *Atriplex patula* L., Sp. Pl. 1053. 1753.

Lectotype: "patula 6", LINN 1221.19! (photograph DAO!), selected by Taschereau (1972).

A. patula var. *bracteata* auct., non Westerlund.

A. patula var. *littoralis* auct., pro parte.

Common names. Spear orache, spearscale, spreading atriplex, spreading orach(e).

Annual, 15–150 cm high, erect or occasionally prostrate, simple or branched. Branches opposite to subopposite to about two-thirds from the base. Stems straight, angular, green and stramineous-striped, becoming tough and woody toward the base. Leaves without kranztype venation, alternate; lower leaves 6–12 cm long, lanceolate with a pair of falcate, forward-pointing basal lobes, irregularly serrate above lobes, or lacking lobes and entire, cuneate to the petiole (0.5–2.0 cm long), acute at the apex, non-succulent, bright green without any red except for occasional slight traces at the margin of some leaves; upper leaves narrow-lanceolate to oblong-linear, entire, or with basal lobes and irregularly serrate, cuneate to the short petiole; apex acute; older leaves glabrous, the younger with fine, evenly distributed mealy particles on both sides but denser on the underside. Monoecious; inflorescence interrupted spiciform, of more or less densely packed glomerules becoming contiguous toward apex, terminal and axillary on stems and branches, without leafy bracts except at base. Plants prolifically fruiting to base. Bracteoles 3–7(–20) mm long, rhombic-triangular to triangular-hastate, green, blackened at maturity; base cuneate to broadly obtuse; apex acute to acuminate; margins often united almost to middle, with lateral angles prominent and usually strongly developed, entire or with 1 or 2 short teeth at the lateral angles; dorsal surface smooth or with irregular, lacinate appendages, foliaceous, thin and lacking spongy inner layer; venation obscure or with midvein alone prominent. Seeds of two types: brown seeds 2.5–3.0(–3.5) mm wide, round, with the radicle inferior, subbasal, the ascending apex pointed; black seeds 1.0–2.0 mm wide, oval, often thicker above radicle, with the radicle basal, outpointing. Pollen periporate, 25(20–30) μm in diameter.

Chromosome number. $2n = 36$ (Bassett and Crompton 1971a; Taschereau 1972).

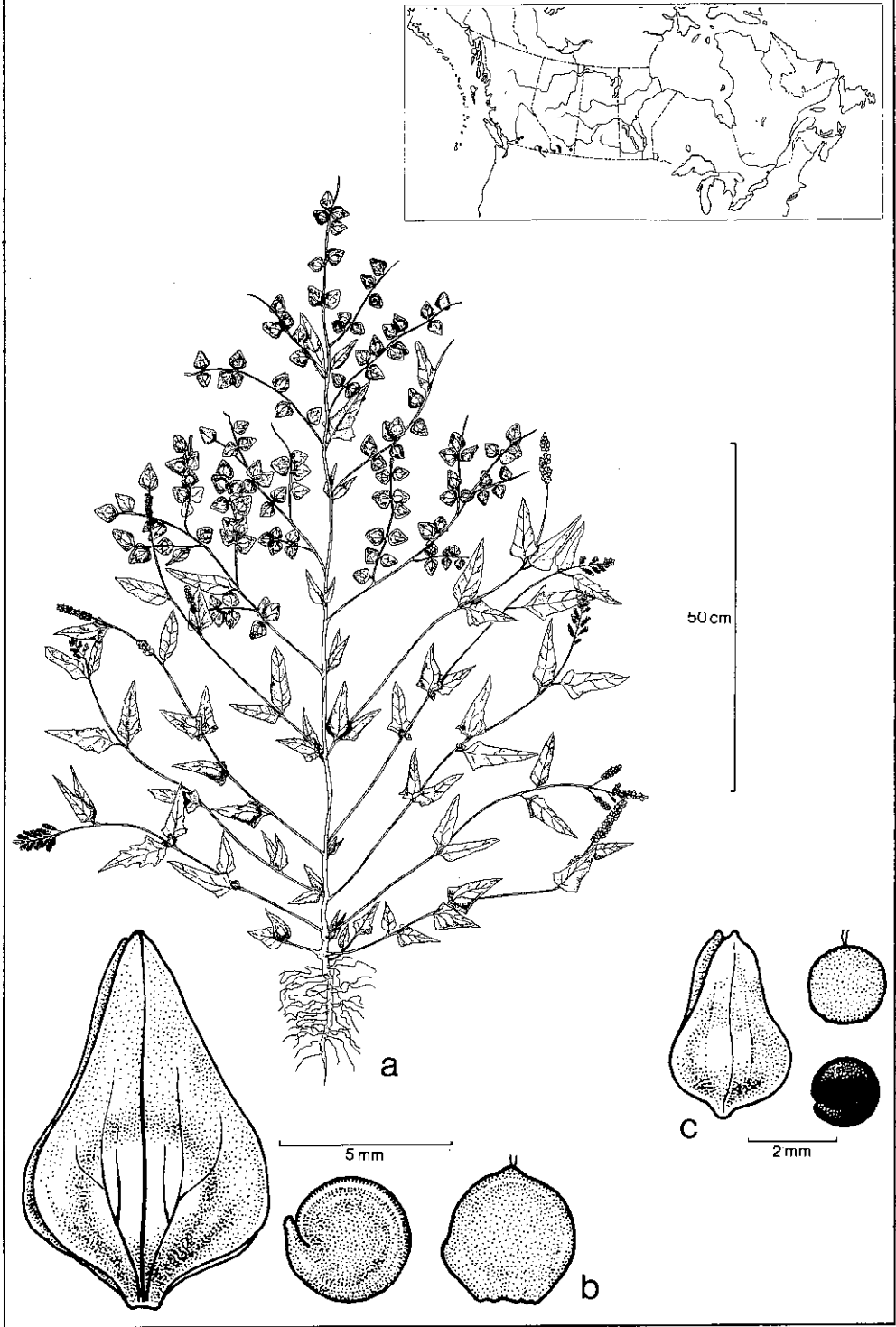


Fig. 5. *Atriplex oblongifolia*: a, plant; b and c, bracteoles with corresponding seed types.

Distribution. Field studies show that *A. patula* is rare in the Prairie Provinces. In British Columbia, Ontario, Quebec, and the Atlantic Provinces, *A. patula* is frequent, though rarely abundant, and often unobserved. Anthrophilic, ruderal, and a weed of disturbed ground, *A. patula* is characteristically a plant of edges: edges of sidewalks and lawns, edges of buildings, edges of land and shore, edges of roads and paths, edges of fencerows and trees. On the coast it is typically confined to the epilittoral belt and is often common on fallen soil banks at the margin of the land and beach.

Flowering occurs from July to September, and fruiting from August to October. *A. patula* does not intergrade with *A. prostrata* ("*A. hastata*") contrary to what is frequently stated in plant manuals. Though some herbarium material may appear intermediate, there is no evidence of hybrids occurring in nature. Hulme's (1958) artificially produced hybrids, *A. patula* × *A. prostrata*, were triploid and largely sterile. Large bracteole forms occur that have been called var. *bracteata* Westerlund. Experimental work (Hulme 1957) indicates that these are sporadic in many populations. They do not deserve taxonomic recognition. The type specimen (S!) of this varietal name is, in fact, a plant of the hybrid *A. longipes* Drejer × *A. prostrata*.

Distribution data and habitat preferences of *A. patula* strongly suggest that this species is introduced rather than native in North America (Fig. 6).

5. *Atriplex acadensis* Taschereau, Can. J. Bot. 50:1577–1579. 1972.
Holotype: Lunenburg, N.S. 21 September 1968, *Taschereau and Wright* 329. (DAO!).

Annual, 20–40 cm high, erect. Branches 1–few, opposite to subopposite, angling outward to upward from main stem, asymmetric, one side of a pair often longer and more developed than the other, sometimes with a lower branch becoming longer than the central stalk. Stems weakly angular, yellow green with faint, thin, green, yellow, and often red-stripped, young parts succulent-herbaceous, older parts becoming tough-woody, markedly straight. Leaves lacking kranztype venation, succulent; lower leaves 4–7 cm long, 3–5 cm wide, triangular–hastate, the lowermost soon deciduous, the petiole 2–3 cm, the margin with a pair of outpointing broad basal lobes, upper and later leaves lanceolate, entire, but with short basal lobes. Monoecious; inflorescence interrupted spiciform, terminal on main stem and branches, and axillary in upper leaves and branches, consisting of loosely packed, widely spaced glomerules, with small linear bracts at base of inflorescence only. Bracteoles 5–7 mm long, ovate–triangular to ovate, green, becoming yellow brown with maturity, sessile or the axillary bracteoles often with footstalk 2–5 mm or longer; apex acuminate; margin with lateral angles not clearly produced, entire or with a single tooth; dorsal surface smooth, sparsely scurfy, rarely with 2 thin,

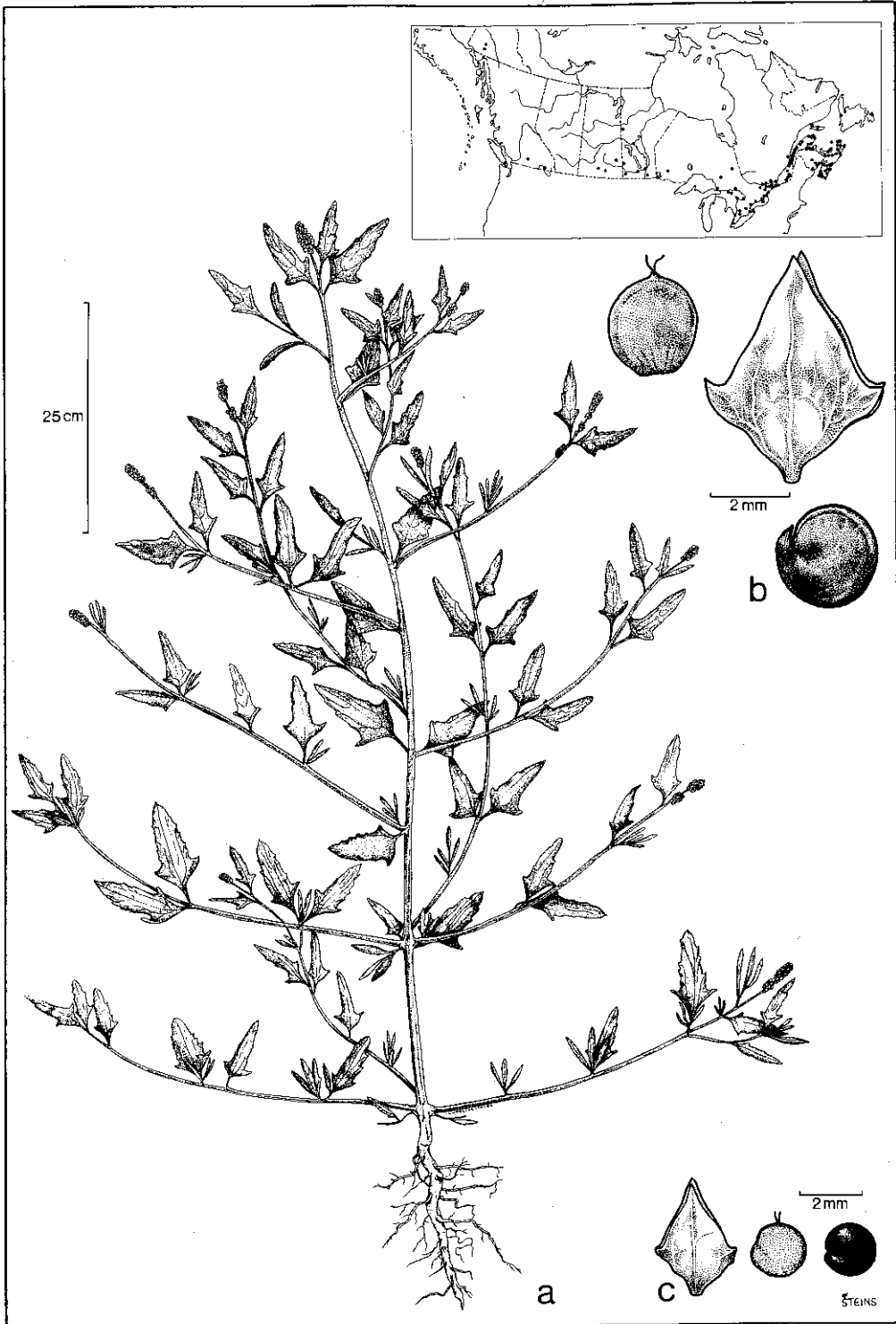


Fig. 6. *Atriplex patula*: a, plant; b and c, bracteoles with corresponding seed types.

weak tubercles. Two seed types present: large brown ones more abundant, 2.5–3.5(–4.0) mm wide, round, the radicle basal to subbasal and outpointing; black ones, 2.0–3.0 mm wide, round, basally more or less flattened, the radicle basal and outpointing. Pollen periporate, 28 μm (25–30) μm in diameter.

Chromosome number. $2n = 36$ (Taschereau 1972).

Distribution. *A. acadensis* occurs on the coasts of Quebec, New Brunswick, Prince Edward Island, and Nova Scotia in Canada, and elsewhere only in Maine, USA (Fig. 7).

Flowering of *A. acadensis* is from August to September; fruiting from September to October. *A. acadensis* is cytologically and morphologically similar to *A. patula*. Both species are tetraploid and neither taxon ever develops a spongy inner layer on the bracteoles. *A. acadensis* differs from *A. patula* in being a shorter, stockier plant, rarely over 40 cm high, with bracteoles ovate–triangular and joined at the base, not rhombic–triangular with the margins united almost to the middle as in *A. patula*. *A. acadensis* is an obligate halophyte occurring in salt marshes and in the halophytic vegetation zones fringing sandy and cobble beaches in protected bays and inlets. It may occur with *A. subspicata* from which it is best distinguished by seed shape: elliptic in *A. subspicata* and round in *A. acadensis*.

6. *Atriplex gmelinii* C. A. Meyer ex Bong., Mem. Acad. St. Petersh. Ser. 6, 2:160. (Observ. Veg. Sitcha 4I). 1832.
Lectotype: Lile de Sitcha [Barnof Island], Alaska, Mertens. (LE!, photograph DAO!)
- A. angustifolia* Sm. var. *obtusata* Cham., Linnaea 6:569. 1831.
Type: “Ad sinum Escholtzii [Eschscholtz Bay, Alaska] in maritimis. Romanzoff Expedition. ?LE.
- Chenopodium zosteraefolium* Hooker, Fl. Bor.-Am. 2:127. 1838.
Isotype: “De Fuca, N.W. America,” Dr. Scouler (K!, photograph DAO!).
- A. zosteraefolia* (Hooker) S. Watson, Proc. Am. Acad. 9:109. 1874.
- A. drymarioides* Standley, N. Am. Flora 21:40. 1916.
Lectotype: Halibut Cove, Cook Inlet, Alaska, 21 July 1899, F. V. Coville and T. H. Kearney 2451 (US!, photograph DAO!).
- A. patula* subsp. *obtusata* (Cham.) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:252. 1923.
- A. patula* subsp. *zosteraefolia* (Hooker) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:252. 1923.
- A. patula* var. *obtusata* (Cham.) Peck, Madrono 6:133. 1941.
- A. patula* var. *zosteraefolia* (Cham.) C. L. Hitchc., Vascul. Plants Pac. N.W. 2:190. 1964.

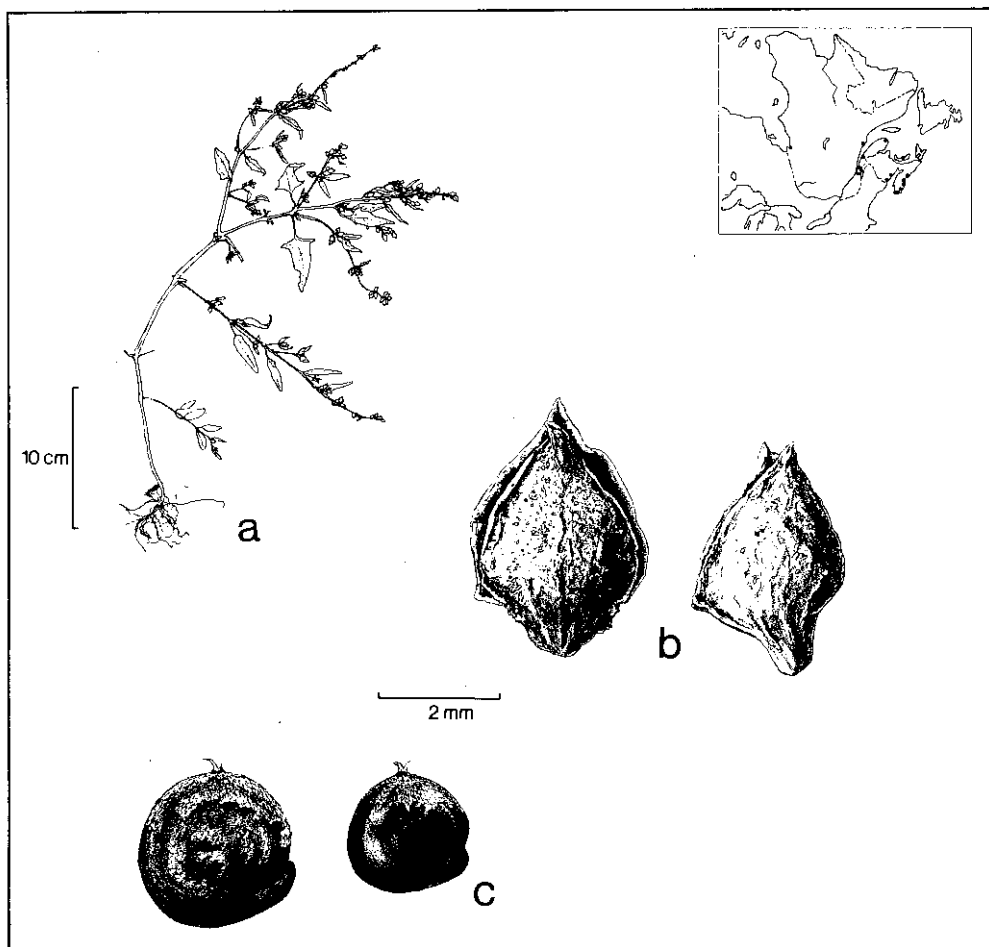


Fig. 7. *Atriplex acadiensis*: a, plant; b and c, bracteoles with corresponding seed types.

Annual, 15–75 cm high, erect or occasionally semierect. Branches few to many, alternate except for the 2 or 3 lowermost opposite pairs. Stems angular, mostly light green with yellowish stripes, becoming slightly woody toward maturity. Leaves lacking kranztype venation; young leaves and stems with some small scurfy scales, green to grayish green or occasionally reddish at or toward maturity, succulent; laminae linear to ovate-lanceolate, occasionally subhastate, obtuse; margins entire or sparsely toothed; petioles 0.5–1.5 cm long. Monoecious; flowers arranged in interrupted short glomerules on the upper stem and branches or in the axils of the upper leaves. Inflorescences without leafy bracts except at the base. Bracteoles sessile or occasionally on short to long pedicels, thick or

leaflike, entire or rarely with a few delicate teeth at the base, oblong to ovate or orbicular, 0.5–25.0 mm long, the small bracteoles frequently not covering the edges of the seed, the larger ones strap-shaped and leaflike, dorsal surface smooth or rarely with a few minute tubercles, inner spongy layer not developed. Seeds of two types: brown, 1.5–2.5 mm wide, as wide as long, flat, round; radicle median ascending to basal with apex curved; black, shiny, 1.5–2.0 mm wide, convex, round; radicle generally basal, the apex curved. Pollen grains periporate, similar to grains of the hexaploid *Atriplex subspicata*.

Chromosome number. $n = 27$, $2n = 54$ (Bassett and Crompton 1973).

Distribution. *A. gmelinii* ranges from the Strait of Juan de Fuca in Washington State, northward along the Pacific Coast to Alaska (Fig. 8). Although *A. gmelinii* is recognized in the floras of the USSR and Japan, specimens we have seen identified as such from these countries cannot be included in our concept of *A. gmelinii*.

Flowering occurs from mid-July to August and seeds develop near the end of August and into September.

Plants were grown from several Alaskan collections of *A. gmelinii* at the different day lengths indicated under the discussion of *A. subspicata* (p. 33). In contrast to the results with the latter species, where flowering was delayed by the longer day lengths, all plants flowered and matured at the same time. Black seeds were only rarely produced: 18 hours of continuous day length gave 5 (2%) black seeds and 241 brown in one trial, and in another trial 1 black seed and 144 brown were produced with 12 hours of interrupted day length. Black seeds are more freely produced in nature, as evidenced by two samples of field-collected seed, 21.5 and 31% of which were black. Larger bracteoles developed at the longer day lengths and with continuous light, the bracteoles were 20 mm long, bractlike, and stalked, resembling some of the extreme collections from Alaskan sites. It would appear that the presence of stalks on bracteoles, on its own, is not a significant character.

7. *Atriplex alaskensis* S. Watson, Proc. Am. Acad. 9:108. 1874.
Lectotype: Barlows Cove, Alaska, Kellog 176. US 48457! (Iso-
type: GH! photograph DAO!), selected by Gustafsson
(1978).
A. patula subsp. *alaskensis* (S. Watson) H. M. Hall & Clements,
Carnegie Inst. Wash. Publ. 326:253. 1923.
A. patula var. *alaskensis* (S. Watson) Welsh, Great Basin Nat.
28:149. 1968.

Annual, 15–100 cm high, erect or ascending from a spreading base, sparingly branched. Stems angular, mostly light green to green with

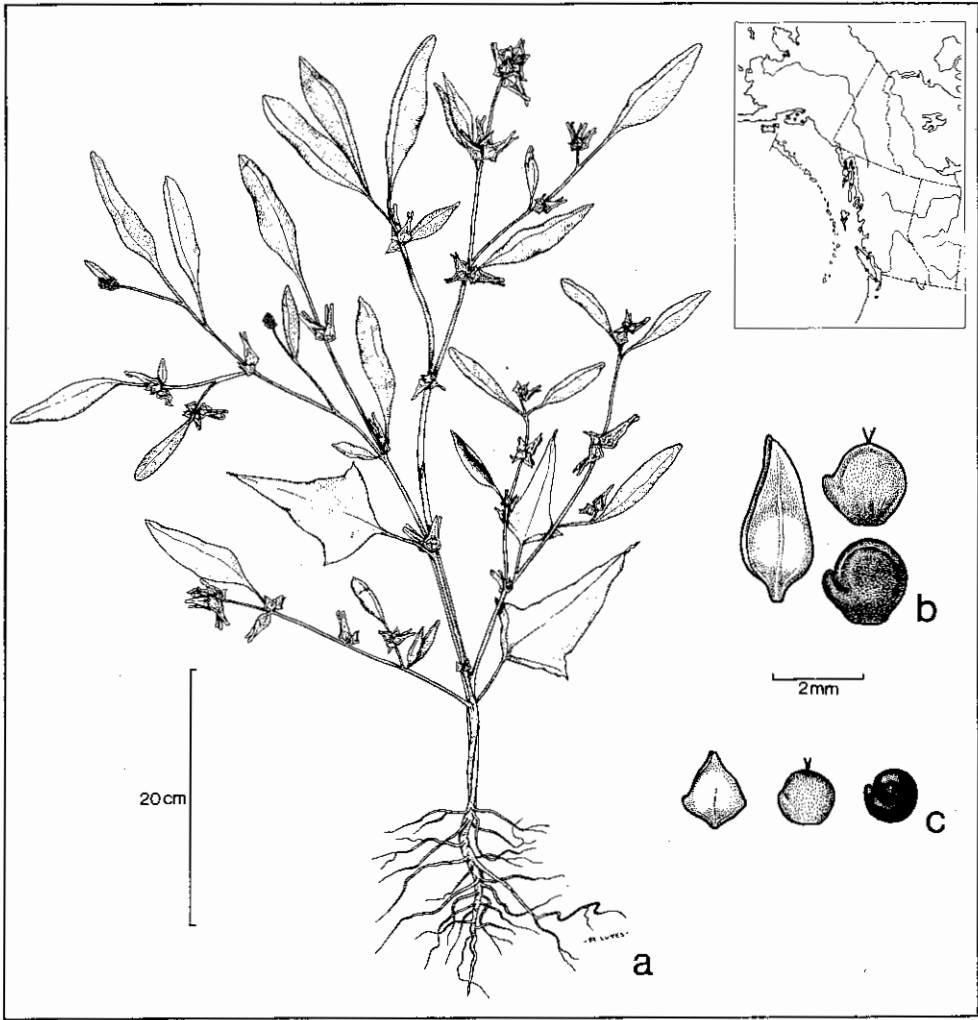


Fig. 8. *Atriplex gmelinii*: a, plant; b and c, bracteoles with corresponding seeds.

yellowish stripes, becoming slightly woody toward maturity. Leaves lacking kranztype venation, alternate, except for the 1 or 2 lowermost opposite pairs, the young rarely scaly, thick, succulent; laminae 2–8 cm long, oblong to oblong-ovate, subcuneate at base, entire or occasionally with 1 or 2 short lobes; petioles 0.5–2.0 cm long. Monoecious; flowers arranged in short glomerules in the leaf axils. Bracteoles 4–9(–14) mm long, up to 9 mm wide, sessile glabrous, thick; light green, entire or occasionally with 1 or 2 minute teeth at the broadest part, rhombic-triangular or sub-orbicular; dorsal surface with a network of veins, becoming indistinct at

maturity, otherwise mostly smooth or with 1 or 2 irregular tubercles, spongy at the base. Seeds brown, dull, 2.5–3.5 mm wide, as wide as or rarely wider than long, flat, the radicle uppointing; black seeds not observed on any of the material examined. Pollen grains periporate, similar in size to the grains of hexaploid *A. subspicata*.

Chromosome number. $2n = 54$ (Bassett and Crompton 1973).

Distribution. *A. alaskensis* ranges from the Queen Charlotte Islands, B.C., through southern Alaska to the eastern end of the Aleutian Islands chain.

Flowering of *A. alaskensis* in Alaska occurs from the latter part of July to August and the plant reaches maturity near the end of August and into September (Fig. 9).

8. *Atriplex subspicata* (Nutt.) Rydb., Bull. Torrey Bot. Club 33:137. 1906.

Chenopodium subspicatum Nutt., Genera 1:199.1818.

Lectotype: Missouri (The right-hand specimen on this sheet is marked "*Chenopodium subspicatum* Nutt., Missouri"; Nuttall's description of the habitat is "In saline soils around Mandan Village, Missouri.") (GH!, photograph 3180, DAO!).

A. carnosa A. Nelson, Bot. Gaz. 34:361. 1902.

Type: Wyoming: Laramie, Albany County, August 18, 1900, *Aven Nelson* 8036. (GH!, photograph 3179, DAO!).

A. patula L. subsp. *hastata* sensu H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:269. 1923, pro parte minore.

Annual, 30–150 cm high, erect or occasionally semierect. Branches few to many, alternate except for the 2–3 (–5) lowermost opposite pairs. Stems angular with light green to green or occasionally light red to reddish stripes, becoming woody at the base. Leaves lacking kranztype venation; young leaves and stems mostly with small scurfy scales, green to grayish green or often reddish at or toward maturity, succulent; laminae lanceolate to linear-lanceolate, rarely ovate to oblong, 3–12 cm long, 2.5–6.0 cm wide, often with a pair of outpointing to forward-curving obtuse lobes; margins irregularly broad-toothed or entire; petioles 1–3 cm long. Monoecious; inflorescences without leafy bracts except at the base. Flowers loosely arranged in interrupted short glomerules on short to long branches or stalks in the axis of the upper leaves. Bracteoles sessile, thick, green, blackening with maturity, broadly triangular to ovate-triangular, 3–10 mm long, usually longer than wide; margins entire or occasionally with short sharp teeth; dorsal surface usually with one or more tubercles with an inflated inner spongy layer, rarely smooth. Seeds of two types: brown, 1.5–3.0 mm wide, wider than long, flattened at

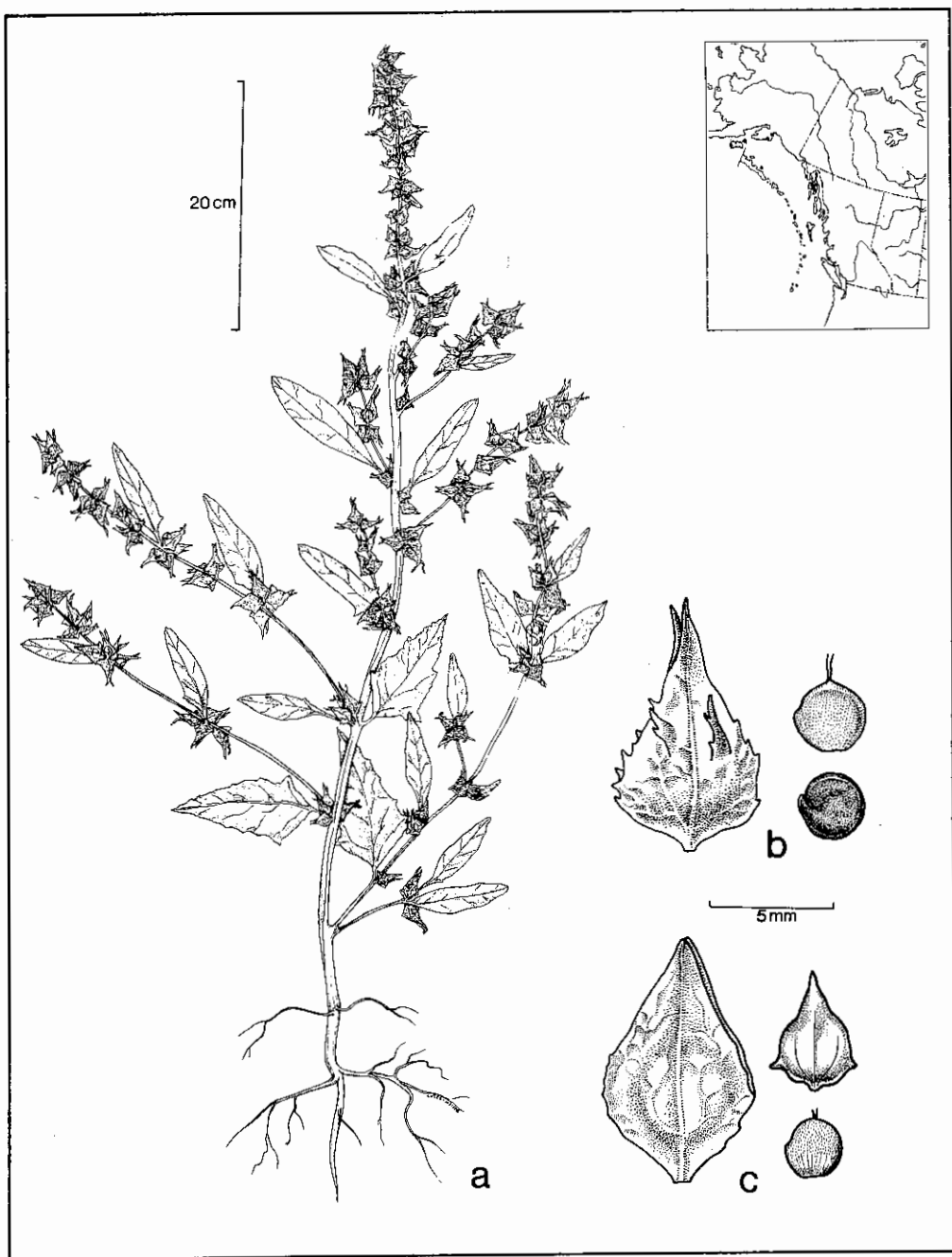


Fig. 9. *Atriplex alaskensis*: a, plant; b and c, bracteoles with corresponding seeds.

the base, the radicle generally median, obliquely outpointing with apex abruptly incurved; black, shiny, 1.0–2.0 mm wide, wider than long, convex, round the radicle generally basal. Pollen grains periporate; grains of hexaploid plants averaging 27 μm (23–29 μm) in diameter; grains of tetraploid plants averaging 23 μm (20–25 μm). Under the scanning electron microscope, grains of the hexaploid plants show pores occupying between 25 and 30% of the grain surface.

Chromosome number. $2n = 36, 54$ (Bassett and Crompton 1973; Taschereau 1972). The report of $2n = 36$ (the tetraploid level) is from plants from Osoyoos, B.C., and Fort Smith, Alta.; all Eastern Canadian collections and plants from 13 other locations in Western Canada were hexaploid ($2n = 54$). No distinctive morphological differences, other than pollen size, were found between plants representing the two chromosome levels except that under greenhouse conditions, tetraploid plants could be distinguished from hexaploids by the position of the leaves: directed sharply downward in tetraploids and horizontal or ascending in hexaploids.

Distribution. *A. subspicata* ranges from British Columbia to Newfoundland in Canada (Fig. 10); in the United States it is scattered in the western states and along the Atlantic coastline as far as North Carolina.

Flowering in Western Canada occurs from mid-July to August and occasionally into September. Bracteoles begin development by late July and mature from late August to early November. Samples of seed from nature contained flattened dull brown seeds and from 0% to 44% shiny black seeds. It was suspected that the length of day had an influence on the percentage of black seed and to test this hypothesis plants were grown in the greenhouse under 9, 12, 15, 18, and 24 hours of light. In addition, plants were exposed to 12 hours of light interrupted after the first 9 hours by 3 hours of darkness. Plants matured earlier with 9, 12, and 15 hours than with the longer day lengths, but black seeds were not produced with 9 and 12 hours of continuous light and only a small percentage with 15 hours. Up to 23% black seeds were produced with 18 hours of continuous light and with 12 hours of interrupted light, and in one test with 24 hours of light, 50% black seeds were produced. It is significant that 12 hours of daylight when interrupted by a dark period resulted in production of black seeds, whereas in 12 hours of continuous light only brown seeds were produced. These preliminary results suggest that in nature, black seeds, which exhibit dormancy, are only produced when there is a continuous dark period of less than 9 hours. Another character, bracteole size, so variable in species of *Atriplex*, was also influenced by varying day length with much larger bracteoles being produced under the longer day length conditions (Bassett and Crompton 1973).

In all probability, *A. subspicata* persisted during the last glaciation to the south of the Wisconsin ice and in some unglaciated areas of the Rocky Mountain region. Its postglacial spread appears to have been rapid and,

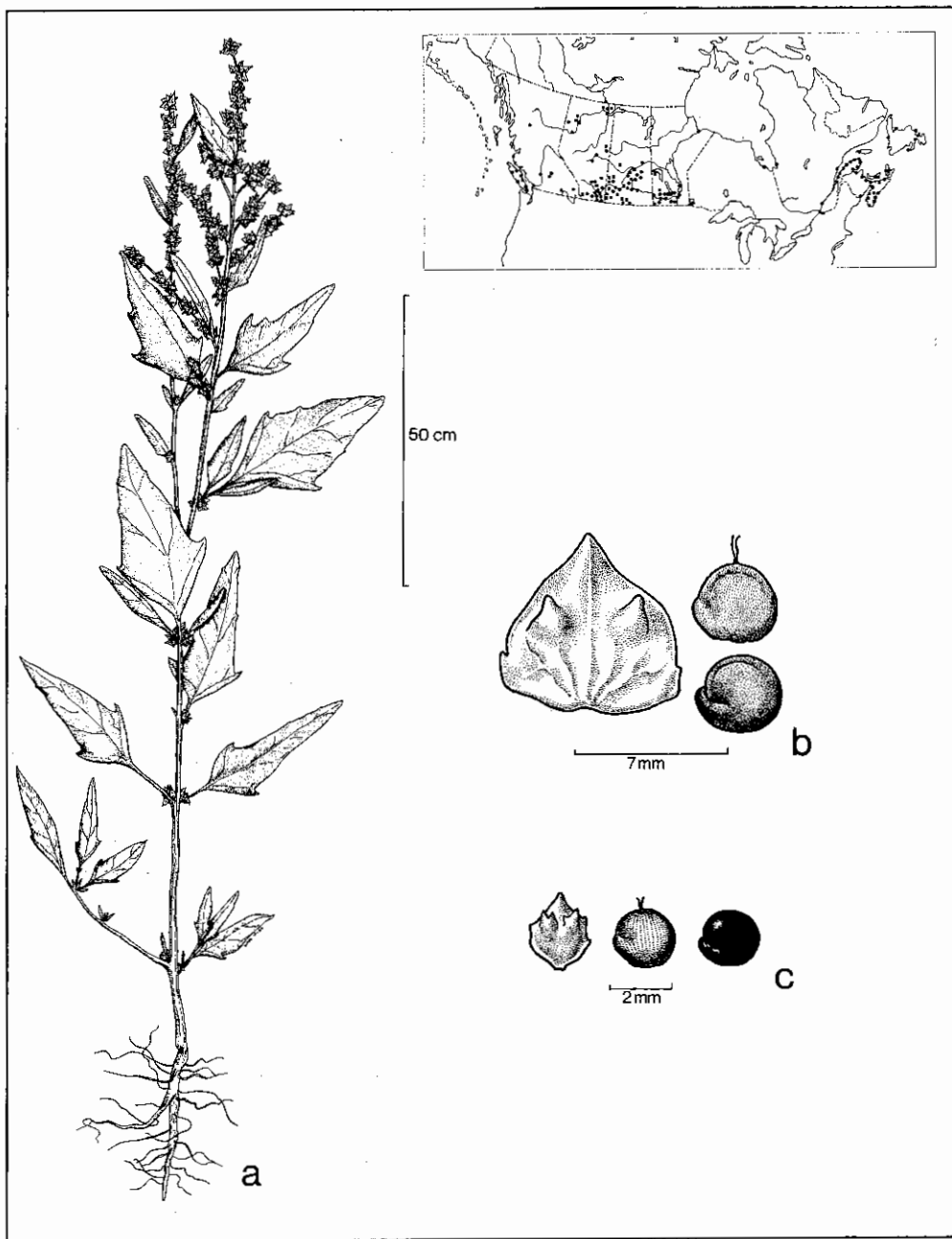


Fig. 10. *Atriplex subspicata*: a, plant; b and c, bracteoles with corresponding seeds.

with changing conditions in eastern North America after the disappearance of alkaline habitats, this species has persisted along the shores of Hudson Bay and James Bay, and on the Atlantic coastline.

In the prairies of Western Canada, *A. subspicata* often appears weedy in saline or alkaline soils, in waste places, at edges of pasture fields, or in cultivated fields and has often been mistaken for the introduced *A. patula* or *A. prostrata*. Narrow-leaved forms of *A. subspicata* have been misidentified as *A. littoralis*, a species that occurs only in the Maritime Provinces (Taschereau 1972.)

9. *Atriplex littoralis* L., Sp. Pl. 1054. 1753.

Lectotype: 3613, No. 1 in Herb. Royen (L!), selected by Taschereau (1972).

A. patula var. *littoralis* (L.) A. Gray, Man. ed. 5. 409. 1867.

A. patula subsp. *littoralis* (L.) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:251. 1923, pro parte.

Common name. Narrow-leaved atriplex.

Annual, 30–100 cm high, erect with narrowly to broadly ascending branches. Branches alternate, except for the 2 or 3 lowermost opposite pairs. Stems subangular, green and stamineous-striped, becoming woody at the base. Leaves lacking kranztype venation, the lower 2–8 cm long, linear to linear-oblong, entire or repand-dentate on upper half; base attenuate to short petiole, green, glabrous; upper leaves narrower, subsessile to sessile. Monocious; inflorescence long (to 20 cm), interrupted spiciform, of densely packed scurfy glomerules widely spaced below but becoming contiguous toward apex, leafless except at base. Bracteoles 5–7 mm long, broadly triangular to ovate, green, becoming brown to black with maturity, more or less inflated with a spongy inner layer strongly or weakly developed, venation prominent at the margins of thinner forms; apex acute; base obtuse to truncate; margins united at base, with lateral angles rounded or weakly developed, denticulate. Seeds of two types: brown ones 2.0–2.8 mm wide, round, more or less flattened along the radicle, the radicle subbasal with apex blunt; black ones 1.5–2.0 mm wide, round, evenly convex, radicle basal, outpointing to obliquely uppointing. Pollen grains periporate, averaging 23 μm (18–25 μm) in diameter.

Chromosome number. $2n = 18$ (Taschereau 1972).

Distribution. In Nova Scotia *A. littoralis* is restricted to the coastal areas along the Northumberland Strait from Cumberland County to Inverness County; it occurs on the Gulf of St. Lawrence coasts of New Brunswick and Prince Edward Island (Fig. 11). It also occurs locally on the coasts of Maine, New Hampshire, and Massachusetts.

The disjunct distribution pattern of *A. littoralis* in North America strongly suggests that it is introduced from Europe.

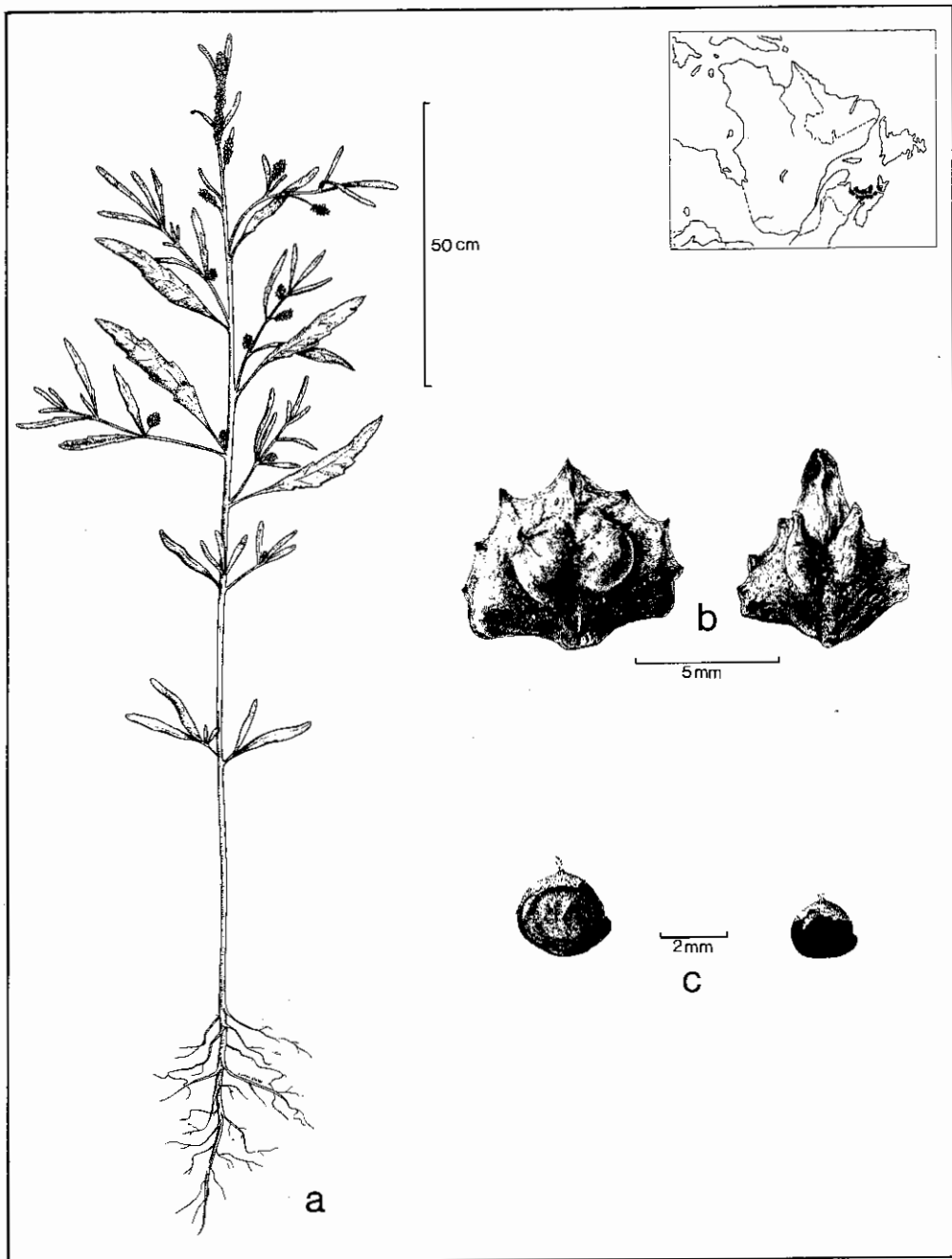


Fig. 11. *Atriplex littoralis*: a, plant; b and c, bracteoles with corresponding seeds.

10. *Atriplex prostrata* Boucher ex DC., in Lam. & DC., Fl. Fr. 387. 1805.
Lectotype: "Env. du Havre," Herb. D.C. 386, marked "*A. prostrata* Boucher" (G-DC.) (Selected by Gustafsson 1976).
A. prostrata Boucher, Extr. Fl. Abbeville 76.1803, nomen nudum.
A. triangularis Willd., Sp. Pl. 4:963. 1806.
Lectotype: Sheet No. 3, "Ipse legi 1804 in Lido di Venezia" initialed "W" and marked "*Atr. triangularis*." In Herb. Willdenow (B; photograph 1450/3!) (Selected by Taschereau 1972).
A. hastata sensu Aellen, in Fl. Eur. 1:97. 1964, et auct. plur., non L.
A. patula subsp. *hastata* sensu H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:249. 1923, non (L.) H. M. Hall & Clements.
A. patula var. *hastata* auct., non (L.) A. Gray.

Common names. Halberd-leaved atriplex, halberd-leaved orache, halberd leaf orach(e).

Annual, 10–100 cm high, erect, decumbent, or procumbent. Branches opposite or subopposite to about two-thirds from the base, ascending or procumbent. Stems subangular to angular, green or stramineous-striped, reddish or not, becoming tough in older parts, straight. Leaves lacking kranztype venation; lower leaves 2–10 cm long, 2–9 cm wide, triangular–hastate with a pair of wide-based obtuse outpointing lobes, entire, broadly serrate, dentate or irregularly toothed or occasionally ovate and entire; base truncate or subcordate, often with a pair of simple or compound teeth toward the outer margin; petiole 1–3(–4) cm; apex acute to obtuse, green or reddish, non-succulent; upper leaves smaller, triangular–hastate to lanceolate, entire or toothed, shortly petiolate or sessile. Underside of young leaves completely covered with scaly scurf or glabrous. Monoecious; inflorescence spiciform, 2–9 cm long, of contiguous or irregularly spaced glomerules that tend to be attached at one point around the axis, leafless except at the base. Bracteoles 3–5 mm long, triangular–hastate to triangular–ovate, green, becoming brown to black with maturity; apex broadly acute; base truncate to obtuse; margins united at the base, with lateral angles mostly entire; dorsal surface smooth or with 2 tubercles, with spongy inner layer present but usually weakly developed; venation obscure or prominent. Seeds of two types: brown ones 1.5–2.5 mm wide, round, flattened along radicle, radicle subbasal, outpointing with apex blunt; black ones more abundant than the brown, 1.0–1.5 mm wide, round, radicle basal, outpointing. Pollen periporate, 23(20–25) μm in diameter.

Chromosome number. $2n = 18$ (Bassett and Crompton 1971a; Taschereau 1972; Gustafsson 1976).

Distribution. *A. prostrata* is fairly common in the Prairie Provinces, especially at the edges of sloughs and saline or alkaline marshy areas, and

is not weedy in cultivated fields. In British Columbia, Ontario, Quebec, and the Atlantic Provinces *A. prostrata* occurs about buildings, in waste places, and occasionally in cultivated fields (Fig. 12).

This species has been called *A. hastata* and more recently *A. triangularis*. Neither of these names can now be applied to this species: *A. hastata* L. correctly applies to a closely related European species that has often been called *A. calotheca* (Rafn) Fries, whereas *A. triangularis* was not published until 1806, a year after the valid publication of *A. prostrata*. *A. prostrata* is a cosmopolitan species. Along with *A. franktonii* Taschereau, *A. praecox* Hülphers, and *A. glabriuscula* Edmondston, *A. prostrata* forms a closely related group of species with similar morphology and identical chromosome number. *A. prostrata* is grazed to some extent, but is rarely abundant enough to be of much importance (Hall and Clements 1923).

11. *Atriplex glabriuscula* Edmondston, Fl. Shetl. 39. 1845.

Type locality: Scotland: Shetland Is: "On stony beaches at Baltasound, Unst" Edmondston. No specimen traced. Application of the name based on original description and examination of topotype material (Shetland, Baltasound, Unst, 27 Aug. 1887, W. H. Beeby. SLB1!) and *neotype* (Scotland, Caithness, Keiss near Wick. 19.9.1930. Leg. M. L. Wedgwood, K!, selected by M. Gustafsson 1976).

A. patula subsp. *glabriuscula* (Edmondston) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:250.1923.

A. glabriuscula var. *oblancoolata* Victorin & Rousseau, Contrib. Inst. Bot. Univ. Montreal 36:14. 1940.

Holotype: Quebec: Trois-Pistoles, 22 August 1930, Marie-Victorin & Rolland-Germain 34004. MT!

A. patula var. *oblancoolata* (Victorin & Rousseau) Boivin, Nat. Can. 93:621. 1966.

Common name. Prostrate atriplex.

Annual, 30–100 cm long, prostrate or, less commonly, erect. Branches many, in a diffuse asymmetric pattern, opposite only at the base, swollen at attachment to the main stem, widely spreading. Stems weakly ridged, green and stramineous-striped, tough-herbaceous, zigzag, undulate, or straight. Leaves lacking kranztype venation; lower ones 4–10 cm long, deltoid-hastate, usually with a pair of outpointing to upcurving basal lobes, irregularly toothed above lobes; petiole long or short; apex acute, more or less succulent; upper leaves smaller, lance-hastate, lanceolate or oblanceolate or triangular-hastate, entire or slightly toothed, the base cuneate to a short petiole; leaves and stems glabrous or sparsely powdery mealy on the underside and about the main veins on the upper side. Monoecious; inflorescence of loose glomerules, axillary and spiciform, terminating stems and branches, leafy bracted to the tip. Bracteoles 5–13 mm long, ovate-triangular to rhombic-triangular, green, becoming

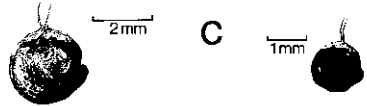
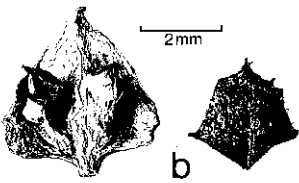
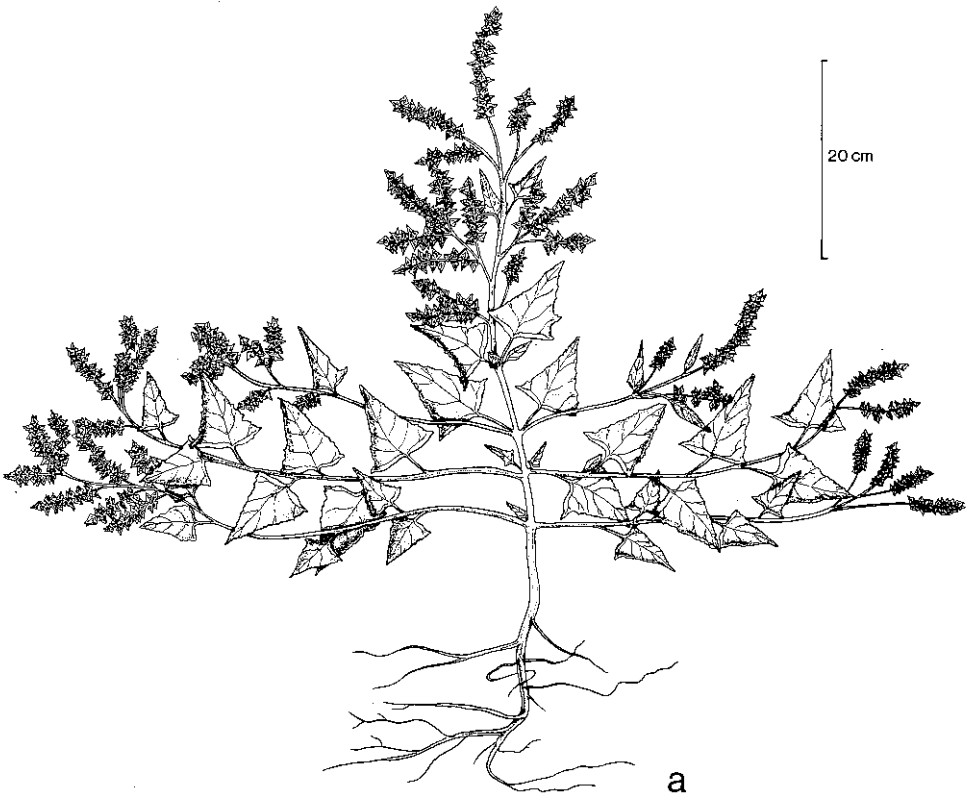
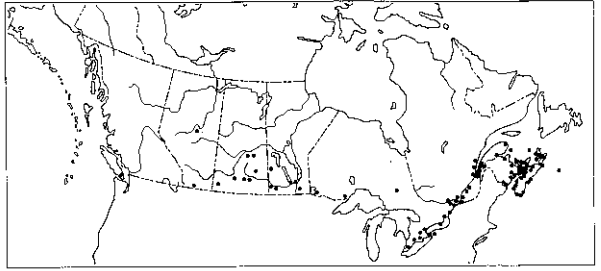


Fig. 12. *Atriplex prostrata*: a, plant; b and c, bracteoles with corresponding seeds.

black with maturity, sometimes reddish; apex abruptly acuminate to a thin foliose tip, margins united almost to middle with few irregular teeth or entire; dorsal surface irregularly muricate, tuberculate, or smooth, inflated with spongy inner layer present and strongly developed, especially at the bracteole base; venation obscure. Large dark biconvex seeds most common, but two seed types may be present; brown ones 2.5–4.0 mm wide, convex, round to oval, the radicle median, uppointing (often strongly so), short, thick, apex blunt; black ones often absent or rare, 1.5–2.5 mm wide, round to oval, the radicle median, uppointing. Pollen periporate, averaging 25 (20–33) μm in diameter.

Chromosome number. $2n = 18$ (Taschereau 1972).

Distribution. *A. glabriuscula* occurs in Quebec, New Brunswick, Nova Scotia, and Newfoundland (Fig. 13). The peculiarities of its distribution, such as its absence from the coastline of the Northumberland Strait, require further study. It also occurs on the eastern coastline of New England and on the coasts of western and northwestern Europe.

A. glabriuscula is extremely variable: the habit varies from erect to decumbent to prostrate, the leaf shape from deltoid–hastate to ovate–lanceolate, the leaf base from subcordate to obtuse, and the leaf margin from entire to sinuate–serrate.

12. *Atriplex franktonii* Taschereau, Can. J. Bot. 50:1586–1589. 1972.

Holotype: In Martin Brook Settlement, Lunenburg, N.S., 21 September 1968, *Taschereau and Wright* 327. (DAO!).

Annual, 15–50 cm high, prostrate, decumbent, or erect. Branches few, asymmetric, the lowermost widespreading and the first 3–6(–8) pairs opposite, becoming alternate above. Stems subangular, green, often red-stripped, becoming tough-woody toward the base, straight. Leaves lacking kranztype venation; lower leaves 4–8 cm long, triangular–hastate with a pair of broad-based outpointing to upcurving acute lobes, irregularly serrate to sinuate–dentate above lobes, the petiole long (1.5–2.5 cm); upper leaves smaller, subsessile to sessile, lance–hastate with a pair of outpointing to upcurving basal lobes or lanceolate and lacking lobes. Leaves and stems glabrous or finely farinose. Monoecious; inflorescence interrupted spiciform, of more or less densely packed glomerules, terminal on stems and branches and in the axils of upper leaves, without leafy bracts except at base. Bracteoles 3–11 mm long, triangular–hastate, green, often reddish becoming brown to black with maturity; apex acute to acuminate; base truncate to subcordate or obtuse, often with a footstalk when arising from leaf axils; margins united at the base, denticulate to lacinate; dorsal surface smooth convex, rarely with two small tubercles; spongy inner layer strongly or weakly developed; venation obscure or sometimes prominent. Two seed types are present and distinct but brown convex intermediate ones are common. Both the brown and the black

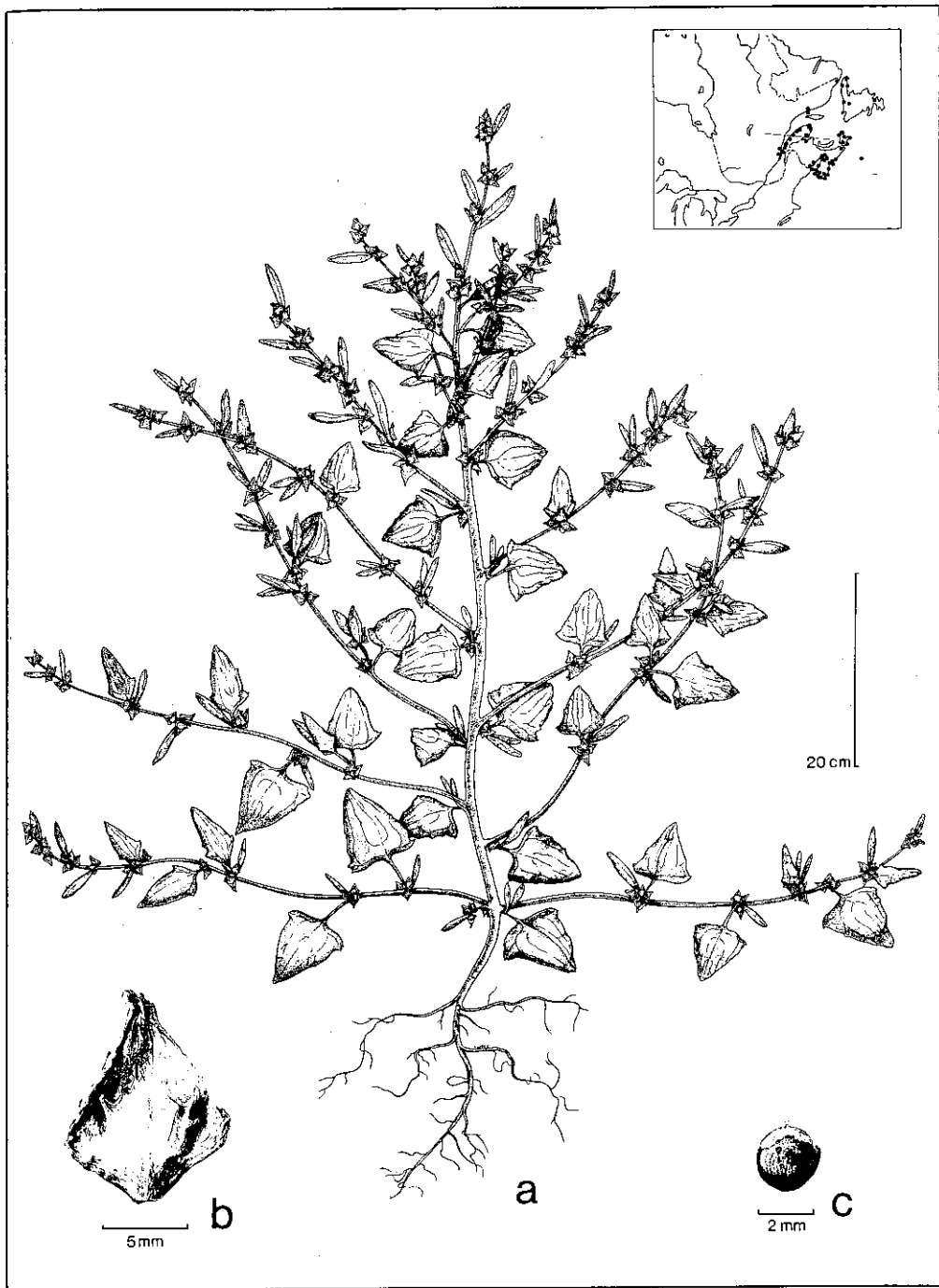


Fig. 13. *Atriplex glabriuscula*: a, plant; b, bracteole; c, seed.

seed types are often slightly wider than long; brown ones 2–3 mm wide, oval or rounded with the radicle subbasal to median, obliquely outpointing, the apex blunt; black ones 1–2 mm wide, round to oval with the radical subbasal. Pollen periporate, averaging 24 (20–27) μm in diameter.

Chromosome number. $2n = 18$ (Taschereau 1972).

Distribution. *A. franktonii* is common on sand beaches bordering the Northumberland Strait and common on the Cape Breton coast (Fig. 14). Lepage (1976) reported this species from Trois-Pistoles, Que., along the St. Lawrence River. It is occasional to common along the Atlantic coast from Guysborough County to Digby County but unknown elsewhere.

Atriplex franktonii matures earlier than *A. glabriuscula*. Under experimental conditions the seeds of *A. franktonii* germinate immediately on planting, whereas those of *A. glabriuscula* require a period of weathering before they will germinate (Taschereau 1972). *A. franktonii* resembles *A. prostrata* in the shape of its lower leaves and in the opposite position of its lower branches, but may be distinguished from it by its larger bracteoles with their pronounced, toothed lateral angles, and by its seed having an obliquely uppointing radicle. *A. franktonii* differs from *A. glabriuscula* in its smaller seeds and in the lack of leaves in the inflorescence.

The features most characteristic of *A. franktonii* and that best delineate it from similar species are as follows: bracteoles with prominent lateral angles often produced into 1–3 short or long teeth; some axillary bracteoles with footstalks; cuneate, falcate-lobed, lanceolate upper leaves.

13. *Atriplex praecox* Hülphers, in Lindman, Sven. Fanerogamfl. 228. 1918.

Lectotype: "Uppland, Sweden, Ljusterösen, Särso, 18: 7. 1912."
A. hulphers subsp. *A. praecox*. S! (selected by Gustafsson 1976).

A. longipes Drejer subsp. *praecox* (Hülphers) Turesson, Lunds Univ. Årsskr. N.F. Adv. Ser. 2.21:6. 1925.

Annual, 3–15 cm high, erect or procumbent. Stems terete or subangular, green or red. Branches opposite up to about two-thirds from the base, the lowermost ones often long-spreading and sometimes longer than the central axis. Foliage bluish green, often tinged with red, succulent, the mature leaves glabrous, the juvenile and upper leaves finely farinose. Lower leaves 1.0–3.0 cm long, 0.5–1.3 cm wide, ovate or lanceolate with a pair of short, outpointing basal lobes; margins entire or with a few short teeth; apex acute or obtuse; base cuneate to attenuate. Upper leaves smaller, lanceolate to linear, without basal lobes; margins entire. Inflorescence entirely axillary or also terminal, 1–3 cm long, composed of loose irregularly spaced glomerules, leafy throughout. Bracteoles 3–5 mm long, sessile or with stalks 0.5–1.5 mm long, rhombic-ovate or

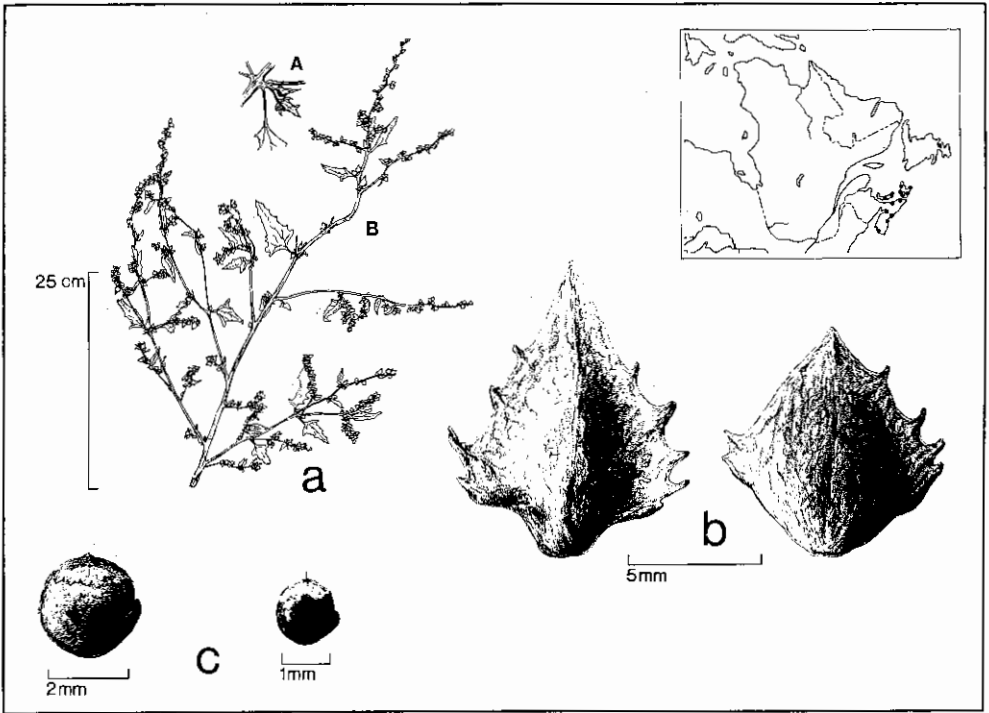


Fig. 14. *Atriplex franktonii*: a, plant; b, bracteoles; c, seed.

triangular-ovate, thin-herbaceous or membranous; apex acute or acuminate; base cuneate, obtuse to truncate; margins entire, united at the base; lateral angles rounded, not or slightly unilaterally developed; dorsal surface smooth, venation obscure. Seeds 1.5–3.0 mm wide, ovoid or suborbicular, 0.1–0.4 mm longer than wide, not distinctly dimorphic, black or dark brown, biconvex, lustrous, smooth or patterned; radicle subbasal, obliquely uppointing to outpointing. Pollen grains periporate, 25 μm (20–28 μm) in diameter.

Chromosome number. $2n = 18$ (Gustafsson 1976; Taschereau 1978b: counts on plants from Scandinavia and from Scotland, respectively).

Distribution. *Atriplex praecox*, a species not hitherto reported from Canada, has been collected at three locations in Newfoundland (Fig. 15). Taschereau (1977a) reports on its occurrence in the British Isles. It has also been found in Greenland, Iceland, Norway, Sweden, Finland, and the adjacent USSR.

The membranous bracteoles of *A. praecox* are so thin that the mature fruit, not merely its outline, can be seen within them.

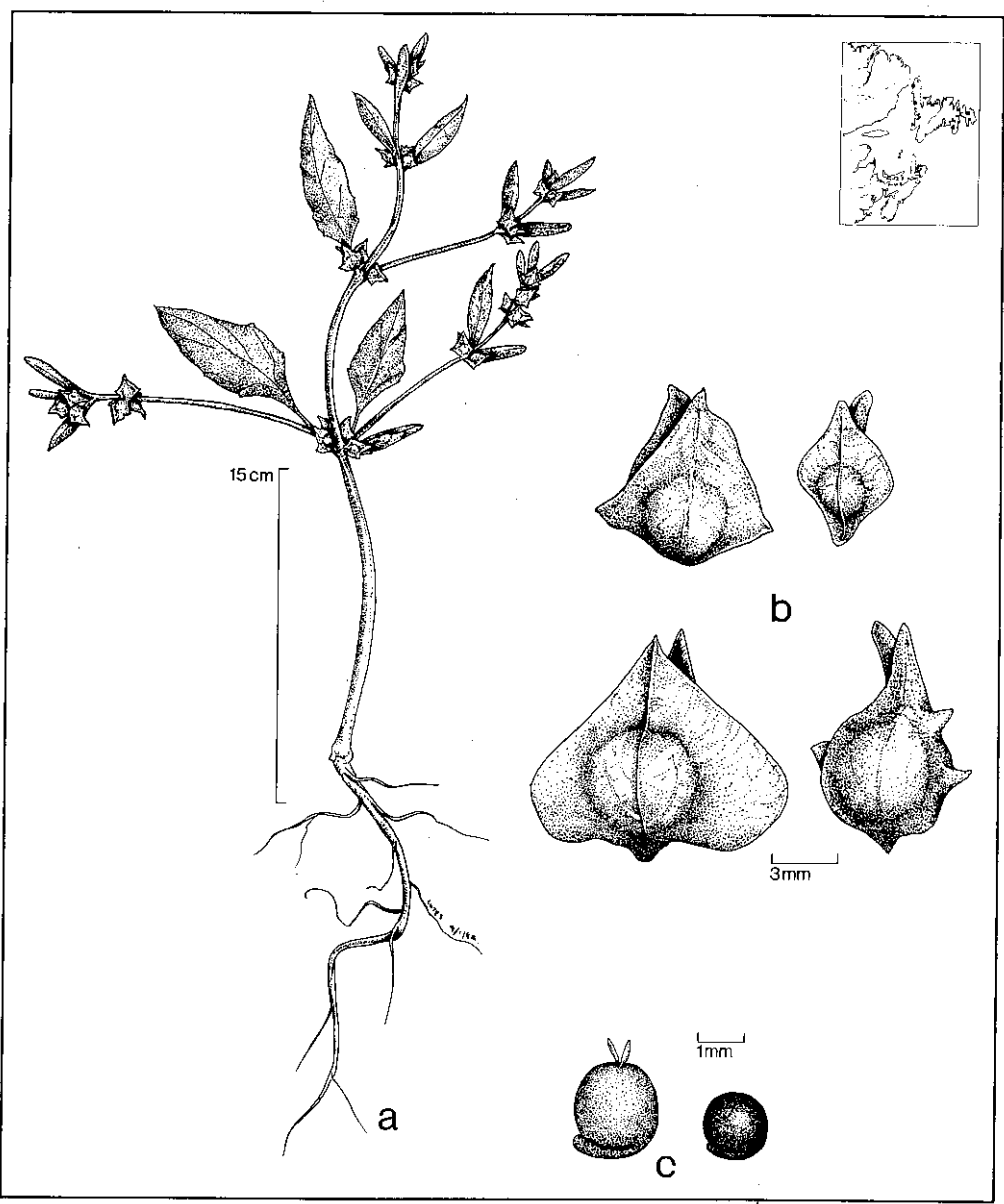


Fig. 15. *Atriplex praecox*: a, plant; b, bracteoles; c, seed.

14. *Atriplex rosea* L., Sp. Pl. ed. 2: 1493. 1763.

Lectotype: Ex horto proprio semen a Zinnio, sub nomine *Atriplex* seminis aculinta in Linnaei specibus non requero. Admodum adfinis videtur Atriplici fructu roseo compresso, (quem?) semen recentim non vide. (Haller's Herbarium Pl., photograph DAO!).

A. spatiosa A. Nelson, Bot. Gaz. 34:360. 1902.

Type: Granger, Wyoming. Aug. 1900. *A. Nelson* 8140. ?RM.

Common names. Red scale, red orach(e), tumbling atriplex, saltbush.

Annual, 100–200 m high, erect or ascending, much branched. Branches ascending or spreading, terete, mealy or glabrous. Leaves with kranztype venation, alternate except the lowermost, up to 6 cm long, ovate or rhombic–ovate to lanceolate, the lower short-petioled, the upper sessile, sinuate–dentate above the cuneate base, usually gray or whitish, rarely green. Monoecious; flowers in axillary glomerules and usually interrupted terminal spikes. Bracteoles 3–6 mm long in fruit, rhombic or ovate, united to near the middle, dentate, the surface usually short-tuberculate. Seeds dull brown, 1.5–2.0 mm broad. Pollen grains periporate averaging 25 μ m in diameter.

Chromosome number. $2n = 18$ (Bassett and Crompton 1970).

Distribution. An introduced species, *A. rosea* is common in the Okanagan Valley, B.C. It has also been found in southern Alberta, southern Ontario, and Nova Scotia (Fig. 16), but it is doubtful if it persists in the eastern localities in Canada because of the less favorable climatic conditions. Abrams (1944) states that *A. rosea* is adventive from southeastern Washington to California. The species is widely distributed in Eurasia, northern Africa, and Australia.

In parts of Nevada the young plants have been used to feed swine (Hall and Clements 1923). However, experiments indicate that the plants are mildly poisonous to sheep when fed in large amounts to the exclusion of other material (Hall and Clements 1923).

A. rosea is weedy and is spreading throughout disturbed habitats in southern Alberta and British Columbia.

15. *Atriplex laciniata* L., Sp. Pl. 1053. 1753.

Lectotype: In Hortus Siccus Cliffortianus (BM!). Selected by Tschereau (1972).

A. farinosa Dumort., Fl. Belg. 20. 1827.

Type: [Belgium:] in arenosis maritimis. ? *Dumortier*. ?BR.

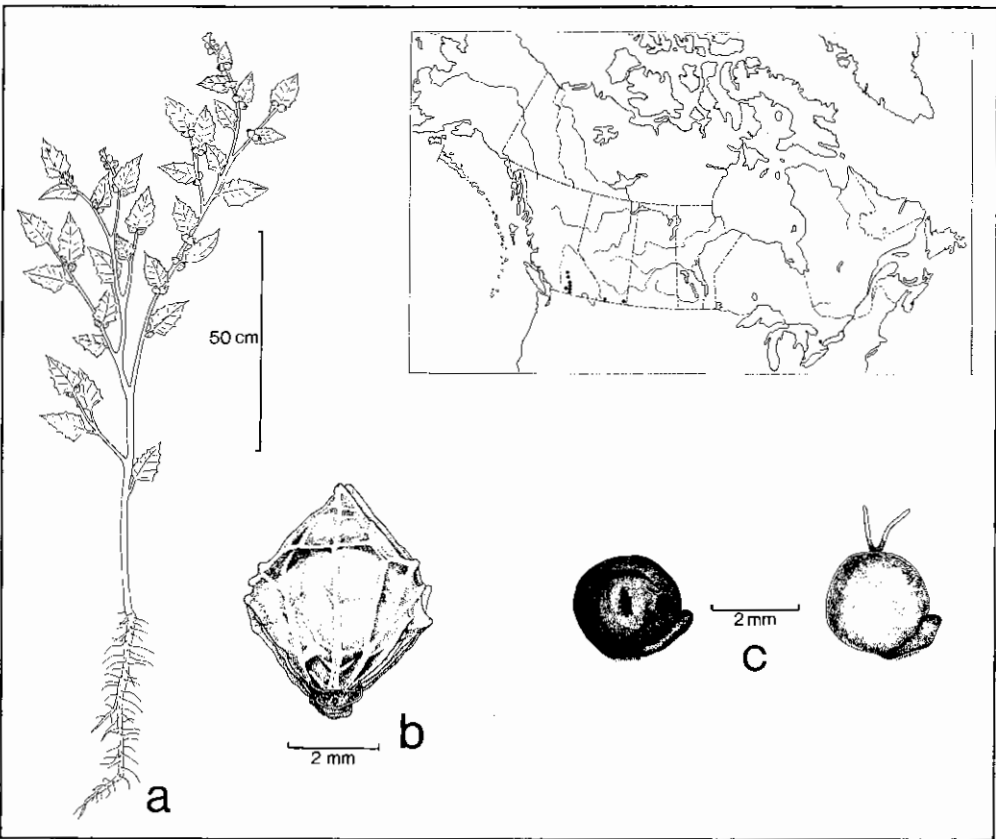


Fig. 16. *Atriplex rosea*: a, plant; b, bracteole; c, seed.

A. arenaria Woods, *Phytologist* 3:593. 1849, non Nutt. (1818).

A. maritima Hallier, *Bot. Z.* 21, Beil. [1]:10. 1863, non Crantz (1766).

Type: [Germany:] Helgoland: "auf der Düne sehr häufig"
Hallier ?JE?

A. sabulosa Rouy, *Bull. Soc. Bot. Fr.* 37: XX 1890. (= *A. farinosa* Dumort., non Forsk. (1775) nec Moq. (1840)).

Annual, 6–30 cm long, decumbent. Branches many, alternate except for the 1–3 lowermost opposite or subopposite pairs. Stems smooth or subangular, reddish or yellowish, slightly woody at the base. Leaves with kranztype venation, whitish green or grayish green, covered with a fine scaly layer on both surfaces but more densely covered below, non-succulent; lower leaves 1.5–4.0 cm long, ovate to lance-ovate, sinuate-dentate with large basal lobes, the base cuneate to a short petiole, the apex

obtuse; upper leaves smaller, narrower, lanceolate or oblong, sinuate-dentate or entire, obtuse, mucronate. Monoecious; inflorescence glomerulate in upper leaf axils. Bracteoles 6–7 mm long, with or without a short footstalk, broadly rhombic, whitish green, becoming scaly black with maturity, lacking a distinctive spongy inner layer but thickened at the base, cartilaginous particularly in the lower half; margins united to middle with lateral angles strongly produced and with margins mostly entire; dorsal surface smooth or with irregular, pointed, or flattened and wing-like tubercles in lower half. One seed type present: light brown, 3.5–4.0 mm wide, transverse-elliptic; radicle median outpointing to obliquely outpointing, thick, the apex strongly produced.

Chromosome number. $2n = 18$ (Taschereau 1972).

Distribution. *A. laciniata* is relatively rare and sporadic within its range in Eastern Canada: a group of several plants may occur, or 1–3 individuals may occur scattered over a stretch of beach, or the species may be absent over large areas of apparently suitable habitat (Fig. 17). Its common habitat is in sand and cobbles on more or less protected beaches.

Flowering in Nova Scotia occurs from July to August, and fruiting from August to September. The habit and appearance of *A. laciniata* are distinctive: the wide-spreading lower branches, often sand-covered for much of their length, turn upward at the tips, and the ascending upper leaves present a silvery undersurface. Fernald (1929) considered *A. laciniata* a native species but we believe that it has probably been introduced from Europe. The bracteoles have a high floating capacity and the species could well have been spread by currents after being introduced in ballast. Evidence from drift-bottle observations indicates that ocean currents in the Gulf of St. Lawrence and the Northumberland Strait could carry floating bracteoles from the mainland to Prince Edward Island, the Magdalen Islands, and Cape Breton Island but not from the Magdalen Islands to other locations (Taschereau 1972).

16. *Atriplex suckleyi* (Torrey) Rydb., Mem. N.Y. Bot. Gard. 1. 134. 1900.
Endolepis suckleyi Torrey, in A. Gray, Rep. Explor. Railroad Pac. Ocean 12(2):47. 1860.
Type: USA: Minnesota – Montana: "Mississippi River westward to Fort Benton." 1853. *Suckley* ?GH.
Kochia dioica Nutt., Genera N. Am. Pl. 1: 200. 1818, non *A. dioica* Raf., Am. Monthly Mag. 2: 119. 1817.
Type: "In sterile and saline places, near the Missouri: abundant near Fort Mandan." *Nuttall*.
Salsola dioica (Nutt.) Sprengel, in L., Syst. Veg. ed. 16, 1:923. 1824.
A. endolepis S. Watson, Proc. Am. Acad. Arts Sci. 9:110. 1874, nom. illegit.

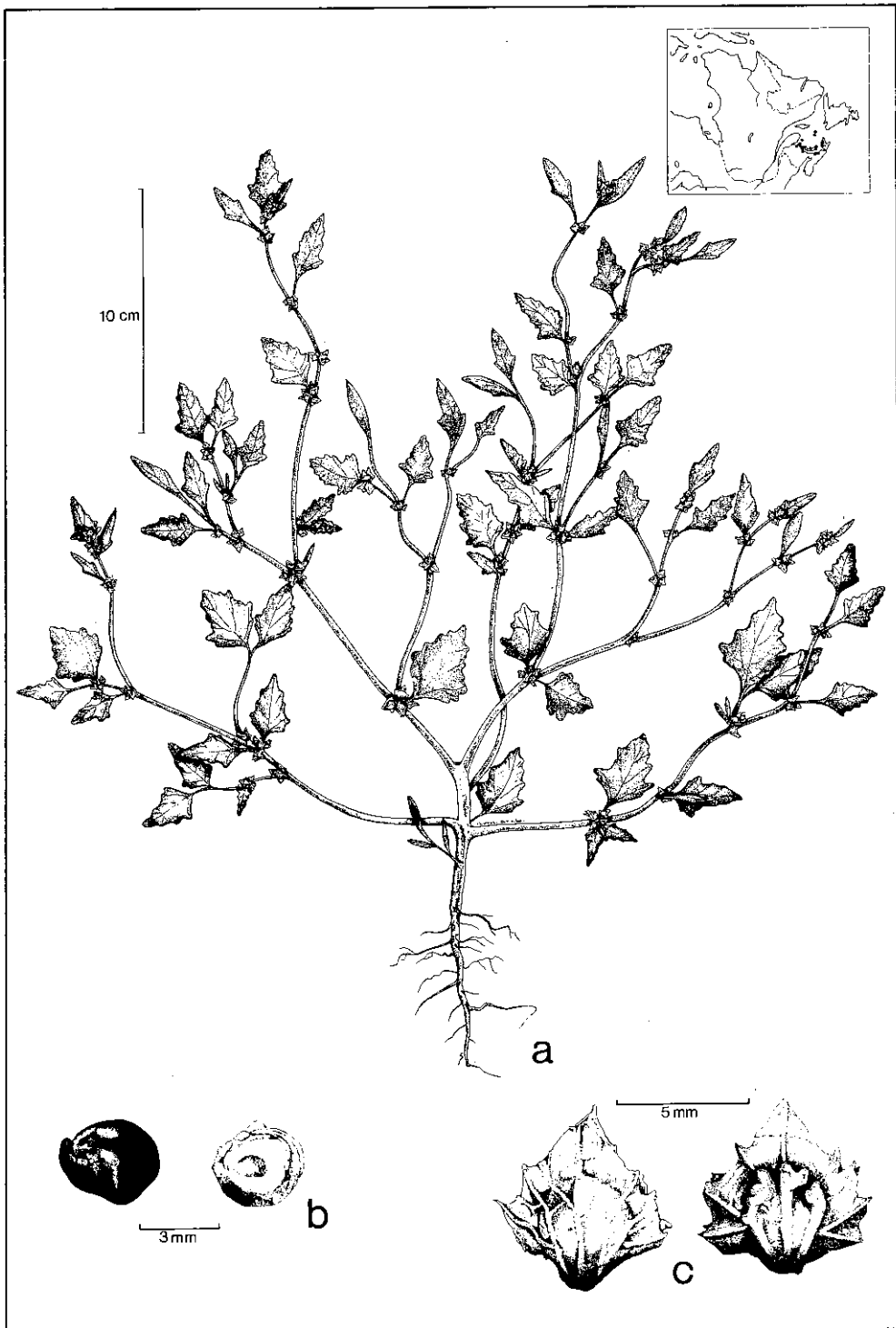


Fig. 17. *Atriplex laciniata*: a, plant; b, seed; c, bracteoles.

Endolepis ovata Rydb., Bull. Torrey Bot. Club 30:248. 1903.

Type: Wyoming: Buffalo, 1900. *Frank Tweedy* 3290. N.Y.

A. ovata F. E. & E. S. Clements, Rocky Mt. Flowers 61. 1914.

Endolepis dioica (Nutt.) Standley, N. Am. Flora 21:73. 1916.

A. dioica (Nutt.) Macbride, Contrib. Gray Herb. Ser. 2, 53:11. 1918, non Raf. (1817).

Common name. Rillscale.

Annual, usually less than 30 cm high and as broad as high, spreading, branching from the base. Leaves lacking kranztype venation, alternate, pale green and glabrous, sessile, lanceolate, tapering to the base; leaf size variable, in some plants a few or most as large as 3 cm long and 1 cm wide but in other plants all about 1 cm long and 0.4 cm wide or even smaller. Monoecious; male flowers mostly in short spikes at tips of stems, frequently pinkish, the perianth with a fleshy crest; female flowers solitary to few in leaf axils. Bracteoles small and difficult to find (Fig. 18), sessile, ovate, united to the summit, without appendages, scurfy, membranous, nearly uniform in size, about 2 mm long and 1.5 mm wide. Seeds 1.2 mm wide, and 1.5 mm long, brown, radicle superior. Pollen grains periporate, 26.5 μm (23.5–30.0 μm) in diameter.

Chromosome number. $2n = 18$ (Frankton and Bassett 1970; Nobs 1975).

Distribution. *A. suckleyi* is limited in its range (Fig. 18). It is only known from southern Saskatchewan and southern Alberta in Canada and from Montana, Wyoming, North Dakota, South Dakota, and Nebraska in the United States.

A. suckleyi flowers from early June to mid-August and bears mature seed before the end of July.

Hall and Clements (1923) mention that this species is usually too sparse and low to be of value even for grazing.

Detailed reasons for adopting *A. suckleyi* rather than the usual name *A. dioica* (Nutt.) Macbride are presented in McNeill, Bassett, and Crompton (1979).

17. *Atriplex semibaccata* R. Br., Prodr. Fl. Nov-Holl. 1: 406.1810.

Holotype: Port Jackson, (Australia). *R. Brown* 3022 (bottom right-hand specimen) (K! photographs DAO! & MTMG!).

A. flagellaris Wooton & Standley, Contrib. U.S. Nat. Herb. 16:119. 1913.

Type: New Mexico: Mesilla Valley, June 1906. *Paul C. Standley* 490. US 562291.

Common names. Australian saltbush, fleshscale, trailing saltbush.

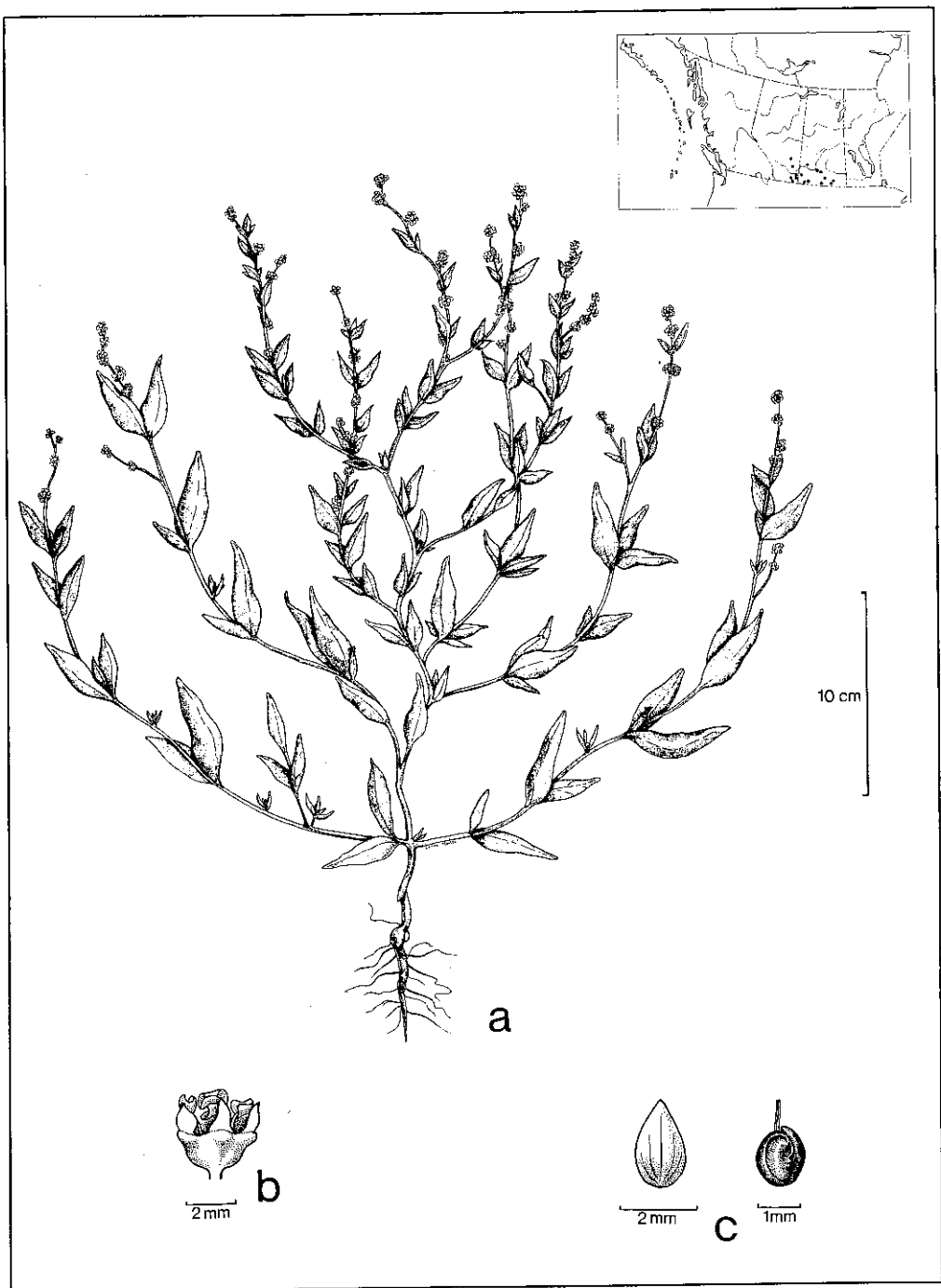


Fig. 18. *Atriplex suckleyi*: a, plant; b, male flower; c, bracteole and seed.

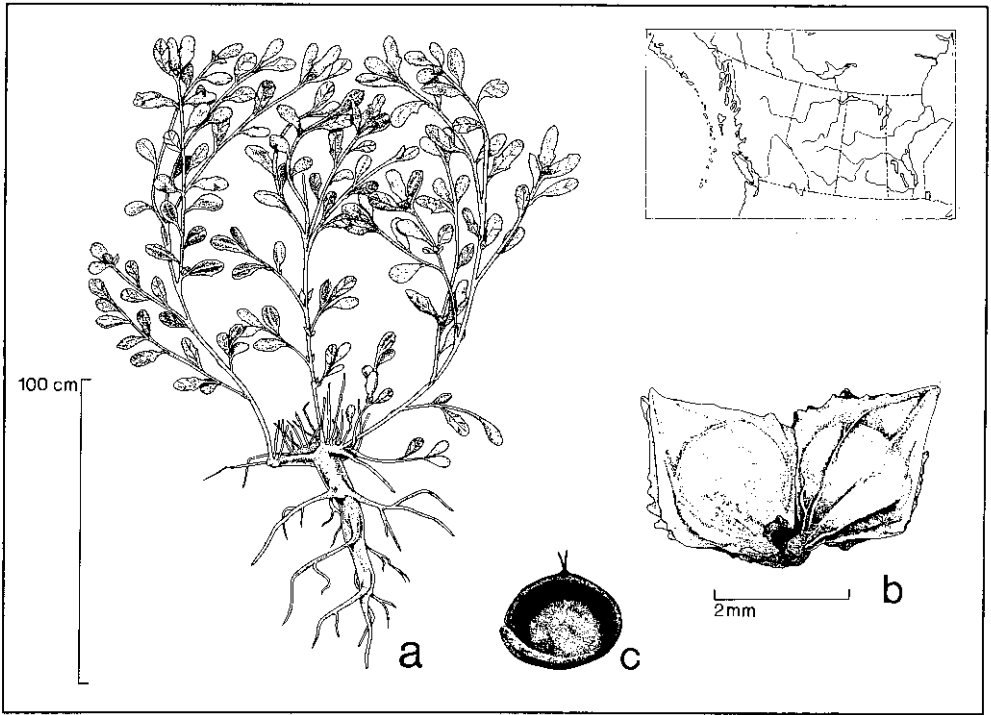


Fig. 19. *Atriplex semibaccata*: a, plant; b, bracteoles; c, seed.

Prostrate perennial, 20–150 cm long, woody at base, much branched. Branches from a basal crown, slender, procumbent, white scurfy, later glabrous. Leaves with kranztype venation, alternate or the lowest sometimes opposite, numerous, about 3 mm long, lanceolate to oblanceolate, sessile or short-petioled, acute or obtuse at apex, margins remotely dentate with 1–10 teeth, gray scurfy. Monoecious; flowers in mixed axillary clusters, the staminate terminating the spikes. Bracteoles in clusters of 1–3, sessile or on short stalks, ovate, scarcely united, entire or slightly dentate, up to 3 mm long. Seeds round, of two types: black ones 1.5 mm wide; brown ones 2.0 mm wide, more convex than the black and with a groove near the margin; radicle lateral. Pollen grains periporate, averaging 26 μm in diameter.

Chromosome number. $2n = 18$ (Bassett and Crompton 1971b).

Distribution. *A. semibaccata* has only been collected once in Canada on Vancouver Island, B.C. (Fig. 19). It is doubtful if it still persists on the island. An Australian native, it is well established in southern California (Hall and Clements 1923). *A. semibaccata* is used for grazing purposes on saline land in the southwestern United States (Hanson, unpublished

1962). When other feed is plentiful, most animals avoid Australian saltbush. It bears no close relationship to the native American species. Australian saltbush is of economic interest also as a host plant for *Eutettix tenella* Baker, the insect that carries the disease of the sugar beet known as curly top (Hall and Clements 1923).

18. *Atriplex argentea* Nutt., Gen. Pl. 1:198. 1818.

Type locality: "on sterile and saline places near the Missouri."

A. argentea var. *hillmanii* M. E. Jones, Contrib. West Bot. 11:21. 1903.

Type: Nevada: East of Reno, 11 August 1894. *Hillman*.
?POM.

A. caput-medusae Eastwood, Proc. Calif. Acad. Ser. 2, 6:316. 1896.

Type: Utah: Recapture Creek, San Juan River. *Eastwood*.
?CAL.

Common names. Silver atriplex, silver saltbrush, silverscale saltbrush.

Annual, 6–40 cm high, erect, strongly branched from the base. Leaves with kranztype venation, alternate except for those at the extreme base, grayish farinose; lower leaves with petioles 0.4–2 cm long, the blades to 3 cm long and usually as broad as long, deltoid, truncate to cuneate at base, not toothed: uppermost leaves sessile and sometimes lanceolate. Monoecious; flowers largely in interrupted glomerules at tips of stem and branches; bracteoles obovate, 4–5(–8) mm long, when mature frequently appendaged, or often with smooth faces; margins dentate. Seeds difficult to remove from bracteoles, up to 1.7 mm long, brown, radicle superior, the tip protruding above the body of the seed. Pollen grains periporate, 22.5 μm (19.5–25.5 μm) in diameter.

Chromosome number. $n = 9$, $2n = 18$ (Frankton and Bassett 1970).

Canadian plants are all referable to subsp. *argentea*; *A. argentea* subsp. *expansa* (S. Watson) H. M. Hall & Clements, which occurs in the western U.S., has a chromosome number of $2n = 36$ (Nobs 1975).

Distribution. *A. argentea* ranges from British Columbia east as far as western Manitoba (Fig. 20), and south to northeastern California and New Mexico.

Flowering of *A. argentea* occurs in Canada from the end of June to August and occasionally into September. Bracteoles can form by early July and sometimes mature before the end of that month. It usually occurs on saline prairies and flats. Occasionally the plants spread from their customary saline habitats and become weedy in fallow fields and disturbed places (Wodehouse 1971).

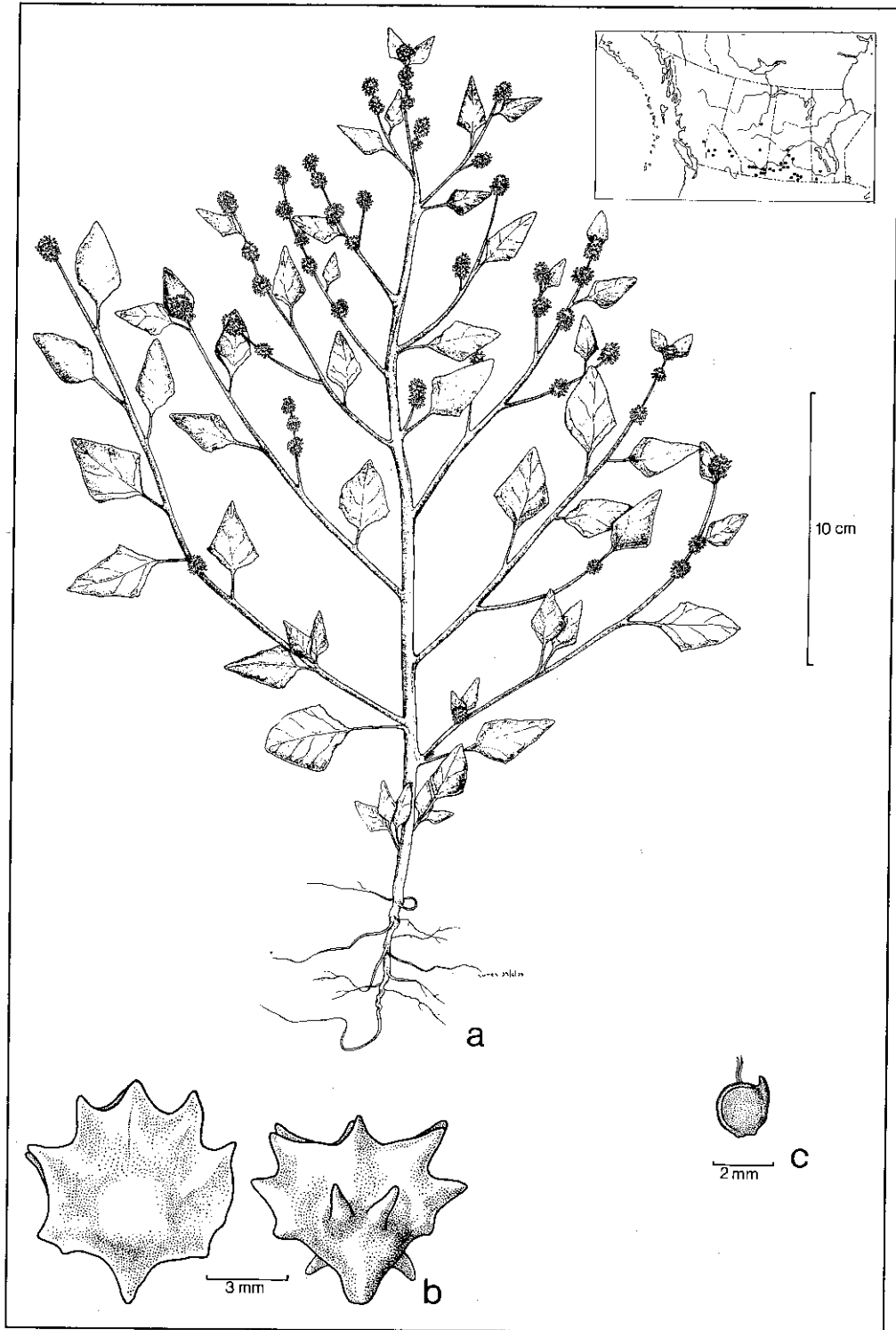


Fig. 20. *Atriplex argentea*: a, plant; b, bracteoles; c, seed.

19. *Atriplex truncata* (Torrey ex S. Watson) A. Gray, Proc. Am. Acad. 8:398. 1872.

Obione truncata Torrey ex S. Watson, Bot. King Expl. 291. 1871.

Lectotype: Banks of Truckee River, N.W. Nevada. . . July 1867. W. W. Bailey 987. (US!, photograph DAO!).

Common names. Wedgescale, truncate saltbush.

Annual, 20–100 cm high, erect with sparsely branched stems. Branches ascending, obtusely angled, those at the base occasionally equaling or overtopping the main stem. Leaves with kranztype venation, alternate, grayish farinose, mostly sessile or subsessile, although larger leaves on some plants may have a petiole to 7 mm long; blades 1.0–2.5 cm long and from two-thirds to three-quarters as wide as long, deltoid, truncate, or slightly cordate or cuneate at base. Monoecious; flowers in interrupted glomerules at tips of stems and branches. Bracteoles sessile, united to the top, the margins entire or slightly undulating, ordinarily smooth on the back but sometimes with 1 or 2 minute tubercles, cuneate, most with 3 minute teeth at the apex, when mature typically about 2.5 mm long and 2 mm wide but rarely to 3.5 mm long. Seeds to 1.5 mm long, brown, radicle superior. Pollen grains periporate, 22.0 μm (19.0–23.5 μm) in diameter.

Chromosome number. $2n = 18$ (Frankton and Bassett 1970; Nobs 1975).

Distribution. *A. truncata* ranges from British Columbia to Saskatchewan (Fig. 21), south to California, Utah, and Colorado. Many of the specimens collected in Saskatchewan were originally misidentified as *A. argentea*. The first collections for Alberta were made in 1969. The species apparently flowers by early July; the distinctive bracteoles can be found in the lower parts of plants by the end of July, although seeds may not be mature until 2 or 3 weeks later. Most of our specimens are from grassy flats near alkaline ponds, but the species also occurs as a weed on road shoulders, railway embankments, and in waste places.

Despite its ruderal habit, wedgescale is not a serious weed. It is grazed throughout its range, but only in restricted localities does it furnish a considerable amount of forage (Hall and Clements 1923).

20. *Atriplex powellii* S. Watson, Proc. Am. Acad. 9:114. 1874.

Lectotype: Cultivated from seed collected by Major J. W. Powell in Arizona (GH!, photograph DAO!).

Common name. Ribscale.

Annual, 10–100 cm high, erect, branched from the base, the lower branches longer than the upper and curved upward, thus giving the plant a columnar form. Leaves with kranztype venation, alternate, grayish farinose, usually prominently 3-nerved, the lower petioled, the upper

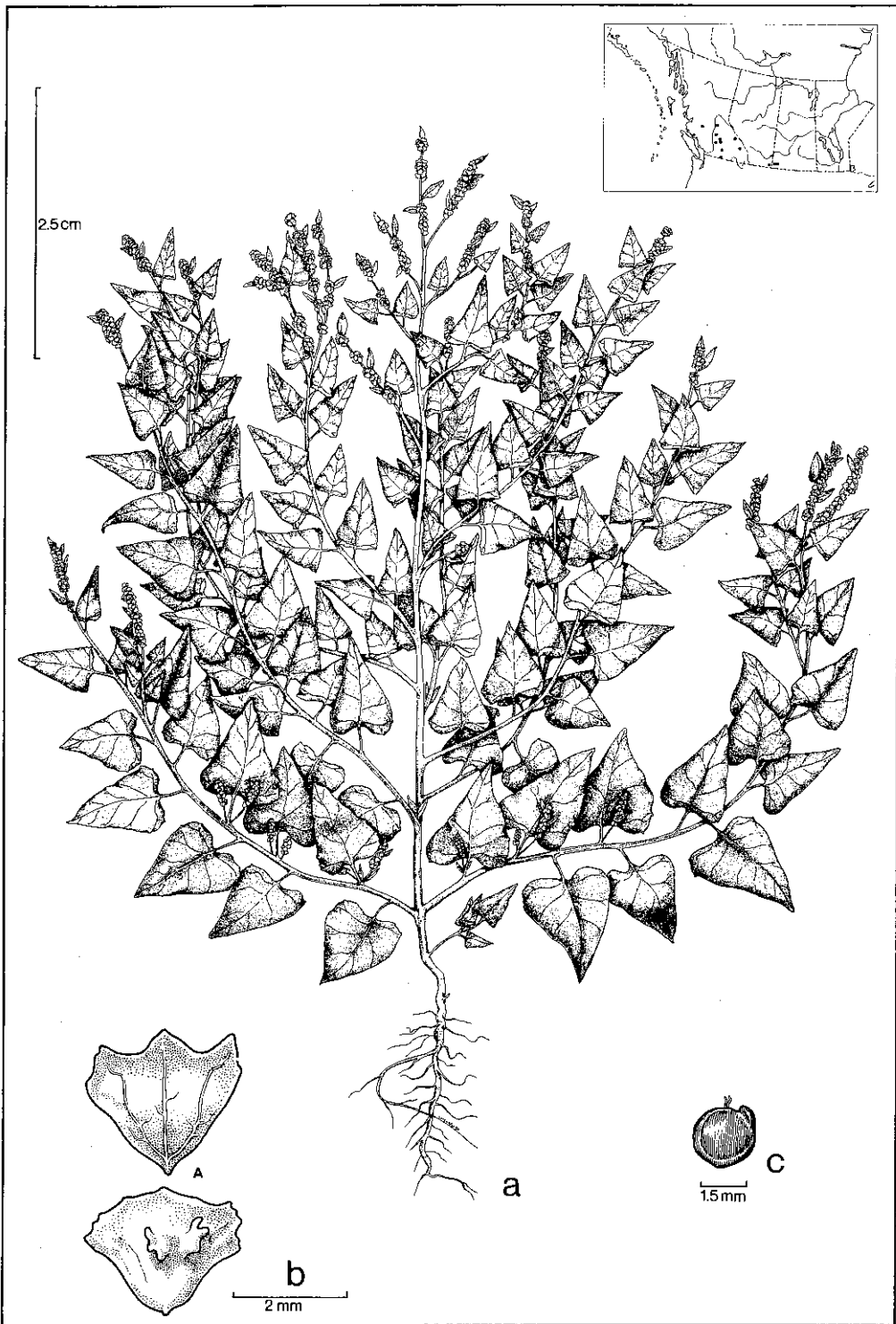


Fig. 21. *Atriplex truncata*: a, plant; b, bracteoles; c, seed.

sessile; blades of larger lower leaves to 2.5 cm long and 2.0 cm wide, those of the upper much smaller, ovate, rounded, or slightly cuneate at base. Monoecious, but some plants almost entirely female. Flowers in glomerules at tips of stem and branches. Bracteoles sessile, united to the apex, more or less oblong in outline, thick, faces usually covered with numerous appendages or these rarely absent or few; the upper part of the bracteole smooth, flattened, broad, almost truncate, to 3(-4) mm long and nearly as wide. Seeds to 1.5 mm long, light brown or yellowish brown; radicle superior. Pollen grains periporate, 23.0 μm in diameter.

Chromosome number. $2n = 18$ (Frankton and Bassett 1970).

Distribution. *A. powellii* ranges from Alberta and Saskatchewan in Canada (Fig. 22), to Arizona and New Mexico with an extension in Oregon in the United States. It extends farther to the north than earlier authors have suspected. This is indicated by the fact that most of the specimens we examined were originally determined as *A. argentea*.

A. powellii flowers by mid-July and bracteoles develop by early August.

21. *Atriplex nuttallii* S. Watson, Proc. Am. Acad. 9:116. 1874.

Lectotype: Saskatchewan, prairie, assez rare, 18 September 1957, Bourgeau (K!, photograph DAO!).

A. buxifolia Rydb., Bull. Torrey Bot. Club 39:311. 1912.

Lectotype: Dayton, Sheridan County, Wyoming, Tweedy 2656 (NY!, photograph DAO!).

A. nuttallii S. Watson subsp. *buxifolia* (Rydb.) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:325. 1923.

Common names. Salt-sage atriplex, moundscale.

Perennial, to 40 cm high, erect or semierect, branching from a woody base, with thin to thick underground roots, the mid-stems mainly herbaceous. Stem and leaves whitish gray to pale green with a dense, scurfy surface. Leaves with kranztype venation, numerous, deciduous, alternate, oblong to linear-spatulate or occasionally spatulate, 0.3-4.0 cm long, 0.2-1.0(-1.2) cm wide, entire sessile, or shortly petiolate. Dioecious; staminate flowers yellow or rarely light brown, the glomerules closely packed in the upper part of the leafy stems or spikes and panicles. Bracteoles in clusters, 3-6 mm long, sessile or shortly stalked, orbicular-ovate, toothed, somewhat spongy, united at or above the middle, the surface covered with many to few short tubercles. Seeds brown, 1.5-2.0 mm wide, 1.5 mm long; radicle basal with tip projecting outward. Pollen grains periporate, 25.5 μm (24.5-27.0 μm) in diameter.

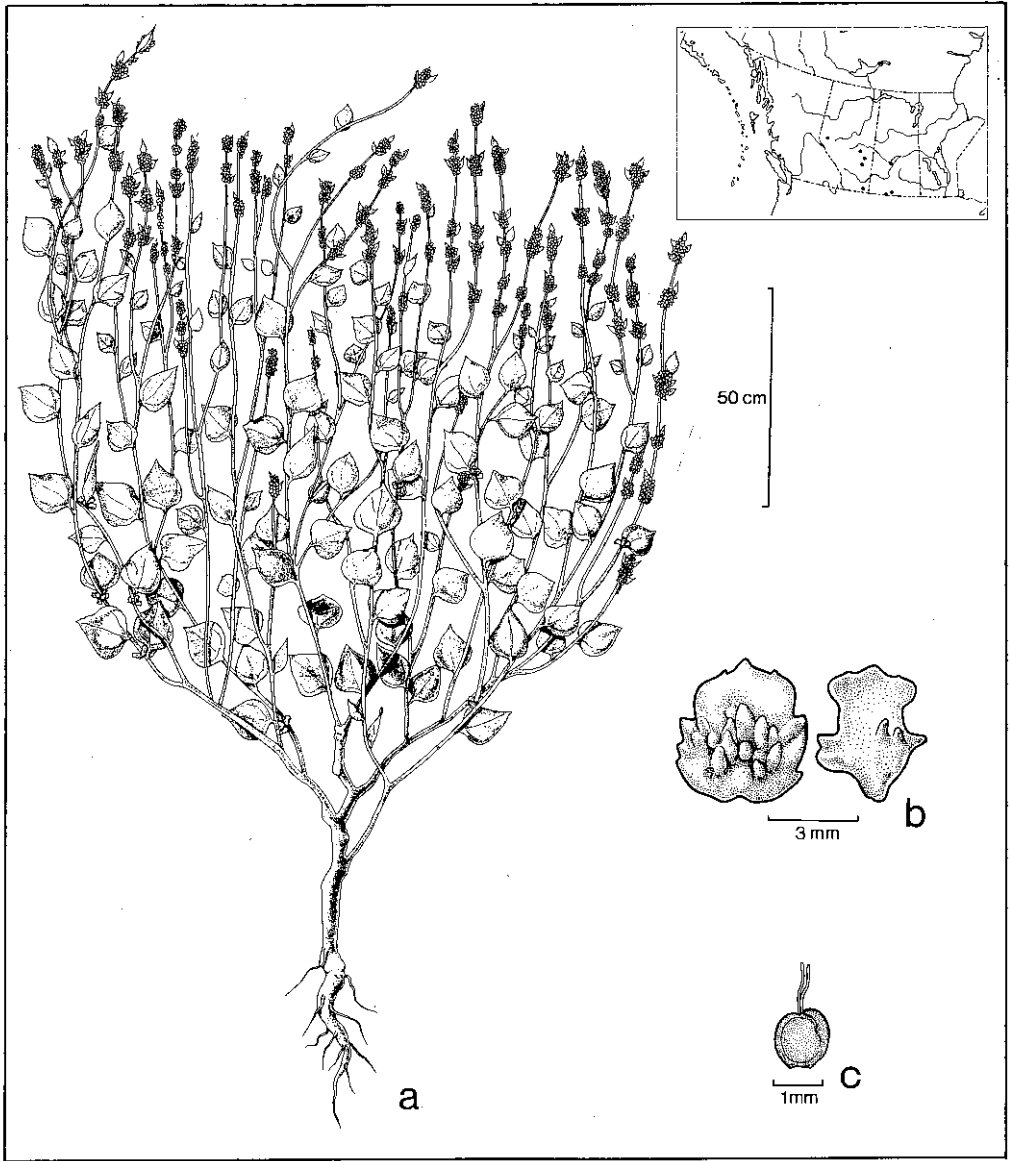


Fig. 22. *Atriplex powellii*: a, plant; b, bracteoles; c, seed.

Chromosome number. Counts of $n = 9$ and $2n = 18$ have been obtained from both Canadian and American locations. Regular pairing of chromosomes was noted in all the material examined.

Distribution. In Canada *A. nuttallii*, a North American native, occurs from the Peace River District of Alberta to Manitoba (Fig. 23). In the United States specimens have been seen from as far south as Colorado.

A. nuttallii is especially common in saline and alkaline habitats on rangelands, badlands, and slopes of coulees in the Prairie Provinces. This is an important browse plant in the alkaline districts where it grows. Stockmen in eastern Utah report it as being very good for cattle and sheep after the snow melts in the spring. Like other saltbushes, however, it is seldom if ever eaten by choice (Hall and Clements 1923).

Hall and Clements (1923) recognize six subspecies within their concept of *A. nuttallii*. One of these, subsp. *gardneri* (Moq.) Hall & Clements is based on *Obione gardneri* Moq., an earlier name than *A. nuttallii*. For this reason Stutz and Sanderson (1979) adopt the name *A. gardneri* (Moq.) A. Dietr. for this species. We prefer, however, to recognize *A. gardneri* as a distinct species of the foothills and Intermountain regions of western USA. It is distinguishable from *A. nuttallii* by its usually narrow leaves and its flat wedge-shaped bracteoles broader above the middle and not or scarcely tuberculate. It has also been claimed (Hanson 1962; Pope 1976; Stutz and Sanderson 1979) that *A. nuttallii* is an illegitimate name. This claim is based on a misinterpretation of the original publication (McNeill et al., in preparation).

22. *Atriplex canescens* (Pursh) Nutt., Gen. Pl. 1:197. 1818.

Calligonum canescens Pursh, Fl. Am. Sept. 2:370. 1814.

Type locality: "In the plains of the Missouri near the Big-bend. July, Aug. v.s. in Herb. Lewis."

Type: [USA: South Dakota: Big-bend of the Missouri between Chamberlain and Pierre. Sept. 21, 1804 (Lewis)]. Am. Phil. Soc., Lewis & Clark Herbarium. (PH!, photo DAO!).

Subsp. *aptera* (A. Nelson) H. M. Hall & Clements, Carnegie Inst. Wash. Publ. 326:343. 1923.

A. aptera A. Nelson, Bot. Gaz. 34:356. 1902.

Type: Laramie, Wyoming, Sept. 1901, *A. Nelson* 738. RM? Fragment "from University of Wyoming." (UC 64938!, photograph DAO!).

A. odontoptera Rydb., Bull. Torrey Bot. Club 31:404. 1904.

Holotype: Buffalo, Wyoming. Elevation 4000-5000 feet. Sept. 1900. *F. Tweedy* 3302. (NY! photograph DAO!).

Common name. Wingscale.

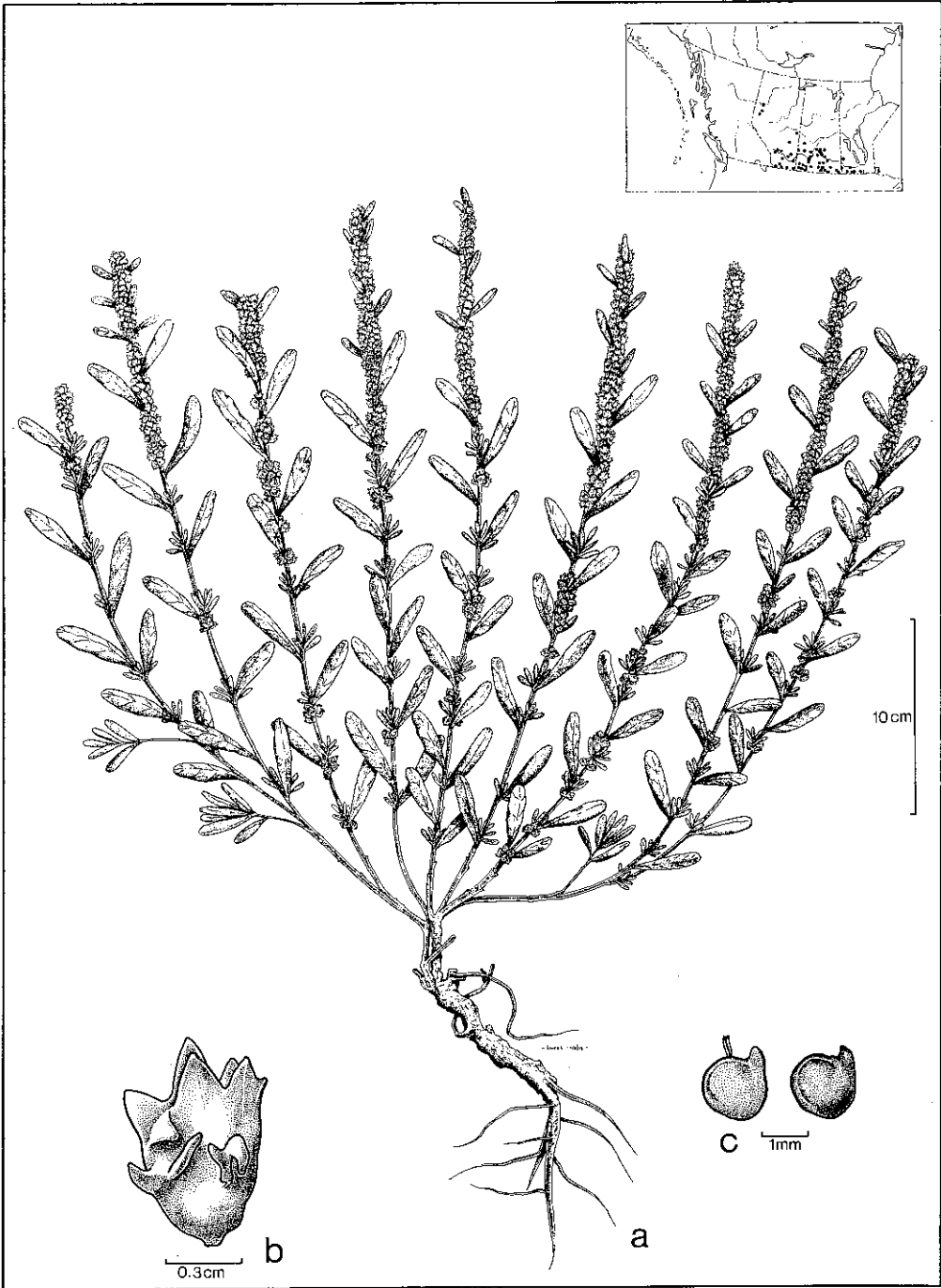


Fig. 23. *Atriplex nuttallii*: a, plant; b, bracteole; c, seed.

Perennial, 15–60 cm high, erect or rarely semierect, branching from a woody base, with generally thick underground roots; upper stems mainly herbaceous. Stems and leaves whitish gray to pale green with a dense, scurfy surface. Leaves with the kranztype venation, 0.5–6.0 cm long, 0.5–2.0 cm wide, numerous, deciduous, alternate, oblong to oblong-spatulate, entire, sessile, or shortly petiolate. Dioecious; staminate flowers yellow to light brown, the glomerules closely packed in the upper part of the leafy stems or spikes. Pistillate flowers in loose to dense leafy bracted spikes and panicles. Bracteoles in clusters, 4–7 (–8) mm long, sessile or on stalks to 5 mm long, united to the top, ellipsoid with 3 to 4 projecting lateral wings extending to 4 mm from the surface; surface bearing several teeth. Seeds brown, 2.5 mm wide, 2 mm long, radicle basal with tip projected outward. Pollen grains periporate, averaging 26.5 μm (24.5–31.5 μm) in diameter.

Chromosome number. $n = 18$, $2n = 36$ (Crompton and Bassett 1975). The pairing of chromosomes was regular. Stutz et al. (1975) reported the discovery in Utah of an endemic gigas population of *A. canescens* with a chromosome number of $2n = 18$. It reached 200–250 cm in height and the authors suggested that it was a relic diploid. Stutz and Sanderson (1979) reported the occurrence of other diploid plants of *A. canescens*, especially in Arizona and New Mexico, as well as hexaploid populations ($2n = 54$) in Nevada and duodecaploids ($2n = 108$) in California. They suggested that the last two may have arisen from hybridization with other species such as *A. falcata* (M. E. Jones) Standley and *A. polycarpa* (Torrey) S. Watson. In addition to more local races, two widely ranging subspecies are generally recognized within *A. canescens*. The one represented in Canada, subsp. *aptera*, is more northerly in its distribution and is distinguished by being a lower growing shrub with somewhat broader leaves and with the bracteoles generally shorter (3–6 mm versus 5–11 mm) and the wings narrower (1–5 mm versus 4–8 mm). The narrower wings make the flattened bracteoles on herbarium specimens appear narrower (3–7 mm versus 6–15 mm). Stutz and Sanderson (1979) claim that the type specimen of the epithet *canescens* belongs to this subspecies, which they suggest is the only one found in the area (South Dakota) where the type was collected. It is true that subsp. *aptera* is commoner in that area but the type specimen that we examined consists of three small shoots, two of which have flowers and fruits and are identifiable. One of these is referable to subsp. *aptera* but the other, the right-hand specimen, belongs to the broad-winged taxon, hitherto called *A. canescens* subsp. *canescens*. We have designated this as the lectotype (McNeill et al. in preparation), thus preserving the current application of the epithet *canescens*.

Distribution: *Atriplex canescens* subsp. *aptera* occurs occasionally in the badland areas of southern Alberta and Saskatchewan (Fig. 24); in the United States we have collected specimens in Montana and North Dakota. *Atriplex canescens* subsp. *canescens* occurs from Oregon, Idaho, and Wyoming south through the western United States and into Mexico.



Fig. 24. *Atriplex canescens* subsp. *aptera*: a, plant; b, bracteole; c, seed.

In 1968, Dr. B. Boivin collected a living plant of a perennial *Atriplex* species 16 km south of Bengough in the Big Muddy Valley of Saskatchewan, and when grown in the greenhouse at Ottawa it was found to have 27 somatic chromosomes. It could be a first-generation hybrid between *A. nuttallii* ($2n = 18$) and *A. canescens* subsp. *aptera* ($2n = 36$). The possibility of a hybrid is supported by the fact that the senior author found both parents growing at the same location, 16 km south of Bengough, when visiting the area in 1969. Unfortunately, this triploid plant died before it flowered.

The chief importance for wingscale is grazing. It is the most palatable of the shrubby species, and has value during drought periods when the supply of other native pasture is absent (Hall and Clements 1923).

According to Wodehouse (1971), *A. canescens* sheds large amounts of pollen that is allergenic.

Glossary

accrescent Enlarging with age; applied to the bracteoles of *Atriplex*, which enlarge after fertilization.

albumen A deposit of nutritive material within the seed coat.

anthropophilic Plants found mainly in areas disturbed by man.

ascending Growing obliquely upward.

asymmetric Not developing equally on both sides.

attenuate Gradually tapering to a slender point.

bracteole One of a pair of small leaflike organs, which in *Atriplex* surround the pistillate flower and fruit; sometimes called fruiting bracts.

bracts Reduced leaves interspersed between the glomerules of the inflorescence.

cartilaginous Firm and tough but flexible, like cartilage.

chartaceous Papery in texture.

columnar Column-shaped, or pillar-shaped.

connate Grown together, or united.

contiguous Touching.

cordate Heart-shaped.

coriaceous Leathery in texture.

cucullate-carinate Hooded, or cowled, and keeled; refers to perianth parts of male flowers.

cuneate Wedge shaped; narrowly triangular with the acute angle downward.

decumbent Prostrate at the base, erect or ascending elsewhere.

deltoid Broadly triangular.

- dentate** Toothed.
- denticulate** Slightly and finely toothed.
- dimorphic** Of two forms, e.g., seeds brown or black, biconvex or flattened.
- dioecious** Bearing staminate and pistillate flowers on separate plants.
- epilittoral** Near the seacoast; transition zone between the mainland and the coast.
- falcate** Sickle, or scythe-shaped.
- farinose** Covered with a mealy powder.
- filiform** Threadlike.
- foliaceous** Leaflike in flatness, color, and texture.
- foliose** Bearing numerous or crowded leaves.
- funiculus** The stalk of an ovule or seed.
- glomerate** Compact, forming a cluster.
- hastate** Spear-shaped with the basal lobes turned outward.
- indehiscent** Not opening along regular lines, usually applied to fruit at maturity.
- lacinate** Slashed or cut into narrow lobes.
- lanceolate** Shaped like a lance head, much longer than wide and widest below the middle.
- lateral angle** The angle formed between the apex and base of the bracteole.
- linear** Narrow and elongate with essentially parallel sides.
- monoecious** Bearing separate staminate and pistillate flowers on a single plant.
- monomorphic** Of one form only. (In *Atriplex* normally refers to bracteoles or seeds.)
- muricate** Rough with short and hard-pointed tubercles.
- oblanceolate** Lanceolate with the broadest part toward the apex.
- oblong** Two to three times longer than broad and with nearly parallel sides.
- obtuse** Blunt.
- orbicular** Essentially circular.
- panicle** A compound or branched inflorescence of the racemose type; often applied to any compound inflorescence that is loosely branched and longer than wide.
- parenchyma** Soft subepidermal tissue with unthickened cell walls. (This tissue is within the bracteoles and tubercles of some *Atriplex* taxa.)
- perianth** Parts of the flower surrounding the male sexual organs.

- pericarp** The ovary wall at the fruiting stage.
- periporate** Pollen grains having many pores uniformly distributed over the surface.
- polysomaty** The existence of tissue containing both diploid and polyploid cells.
- radicle basal** Radicle positioned near the bottom of the seed.
- radicle lateral** Radicle positioned near the equator of the seed.
- radicle superior** Radicle positioned near the top of the seed.
- repand** With a shallow sinuate or slightly wavy margin.
- reticulate** Netted; usually referring to the kranztype venation of the leaves of some *Atriplex* taxa.
- rhombic** With the outline of an equilateral oblique figure.
- sinuate-dentate** Wavy and toothed.
- spatulate** Spatula-shaped, somewhat broadened toward a rounded summit.
- squamulose** Provided with small scales.
- stramineous** Straw colored.
- striate** Marked with fine and usually parallel lines.
- subulate** Awl-shaped.
- testa** The outer covering of a seed.
- truncate** With the base or apex transversely straight or nearly so, as if cut.
- tubercules** Knobby or ovoid projections.
- undulate** Wavy margined.
- unisexual** Bearing stamens or pistils but not both.
- utricle** A small, thin-walled, one-sided, more or less inflated fruit.
- vestigial** Rudimentary.

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