

## IDENTIFICATION

# Terminology and identification in the annual native *Atriplex* species of the British Isles: Part II Identification and key

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*Atriplex x taschereaui* hybrid derivative. Note the short triangular leaves and very large, leaf-like, non-spongy bracteoles, elongate spines and pseudostalks. Tongue, Sutherland, Scotland. 2nd September 1975. Taschereau MANCH collection, 1978.

In the first article of this series, to be published in the *Journal of British and Irish Botany*, I have dealt with the descriptive terminology used in the identification of the annual native *Atriplex* (oraches), and described findings from a ten-year study based on Norfolk plants and an analysis of the Taschereau MANCH collection of *Atriplex longipes* and its hybrids. Here, I present a key derived from these findings, together with illustrations.

### Characters and terminology

The main findings of my study, for the purposes of the key, can be summarised as follows.

**Leaf basal angle:** I found, as did Taschereau, that mid-stem as well as lower-stem leaves could be used for this character. Those with the maximum basal angle are the diagnostic ones: maximum angle  $180^\circ$  –  $220^\circ$  (truncate – subcordate) in *A. prostrata* and *A. glabriuscula*; c.  $180^\circ$  (truncate) in *A. x gustafssoniana*

and *A. x taschereaui*; c.  $160^\circ$  in *A. longipes* s.s. and *A. patula*.

**Basal leaves:** in *A. patula* these can all be simple, with no basal lobes; these plants will tend to key out in standard keys to *A. littoralis*.

**Exaggeratedly long basal lobes** are frequent in *A. longipes* s.s. and *A. x gustafssoniana*.

**Elongate triangular (or trullate) leaves**, where the central segment of the lower- or mid-stem leaves (minus basal lobes) has a length to breadth ratio of  $>2.5$ , are characteristic of *A. longipes* s.s. and *A. x gustafssoniana*, but very infrequent in *A. prostrata*.

**Leaf succulence** is especially characteristic of *A. longipes* s.s., but can also be found in *A. x gustafssoniana* and *A. glabriuscula*.

**Yellow leaf colour** at maturity is a good field character for *A. longipes* s.s. and *A. x gustafssoniana*. *A. prostrata* in saline conditions normally turns a deep purplish red, never yellow.

**Bracteole lengths**, much used in standard keys, were found to be enormously variable and of little use in identification.

**Bracteole basal angle** (the angle subtended by the lower edges of the lateral laminae) should be used rather than 'proportion fused', as it is much more constant in any one taxon: 130°–180° in *A. prostrata*; 80°–110° in *A. glabriuscula* and *A. patula*; in between in the other taxa. The point of fusion is always at the widest point of the bracteole pair, between the lateral angles if present, and the basal segment of the bracteole pair below this point is pretty constant in shape and length. On the other hand, the length of the distal segment varies enormously with the length of the foliose portion. Forms of *A. patula* are frequent where the bracteoles have very long or even leaf-like foliose portions and these will key out wrongly in standard keys, because the proportion fused will be well below one-third.

**Bracteole basal thickening** can be either incompressible (woody or cartilaginous) or compressible (spongy), and should be looked for by examining the bracteole pair from the side.

**Foliose portion:** the shape of the flap-like portion of the bracteole pair, above the fruit compartment, can be very useful: very short in *A. glabriuscula*, but long in *A. x taschereaui*; tending to narrow and tongue-shaped in *A. littoralis*; showing a definitely convex edge in *A. prostrata*, but a more or less straight edge in *A. patula* and *A. longipes* s.s.; sometimes with a concave edge and drawn-out acuminate tip in *A. x gustafssoniana*.

**Serration:** most taxa can have an entire or serrate edge to the foliose portion, but in *A. longipes* s.s. the edge is always entire or subentire.

**Spininess:** again most taxa can have either smooth or spinous bracteoles, but in *A. longipes* s.s. there are never any true spines, although the bracteole surface may be bumpy (muricate).

**Elongate spines:** Very large axillary bracteoles (<40mm) in *A. x taschereaui* often bear elongate spines with a l:b ratio of 3–6. These are diagnostic.

**Prominent and reticulate venation** were said by Taschereau to be characteristic of all the *A. longipes* complex. I confirmed this, but only in dried specimens. In *A. x taschereaui* there is often a particularly broad mid-vein with a fusiform swelling at its base from which prominent veins arch upwards connected by cross veins (reticulate venation).

**Pseudostalks** may occur in *A. x taschereaui*, where the broad and prominent mid-vein may extend up to 10mm or so downwards as a stalk-like protrusion with a very narrow and gradually attenuating wing of bracteole tissue on each side. This is again diagnostic, if present.

**Bracteole stalking** hardly occurs on inflorescence branch bracteoles, usually only on axillary bracteoles, and is not confined to the *A. longipes* complex, being found occasionally in *A. patula* (<5mm), and *A. laciniata* (<19mm). The use of bracteole stalk length to separate *A. x gustafssoniana* (<5mm) from *A. longipes* s.s. (>5mm) was broadly confirmed by my study. However, my findings suggested that plants with bracteole stalks only a little over 5mm long, but with spines, serrations, and concave-edged foliose portions, should be assigned to *A. x gustafssoniana*.

**Seed radical direction** and point of origin are of crucial importance in separating *A. prostrata* from *A. glabriuscula*. There is no constant difference in leaf shape between these two taxa, and *A. prostrata* growing on or near a beach can have succulent greyish leaves with much mealiness. Such plants can also have tiny, almost spherical, bracteoles, with very short foliose portions, inviting confusion with *A. glabriuscula* unless the seed radicle is checked.

### Hybrid derivatives in the *Atriplex longipes* complex not dealt with in standard keys

My study of the Taschereau MANCH collection showed that around a third of the specimens of the two hybrid taxa within the *A. longipes* complex had all sessile bracteoles. This was sometimes remarked on by Taschereau on the sheets, but these forms (probably segregates rather than introgressives) were not allowed for in his key (Taschereau, 1985). Forms of *A. x taschereaui* with very large leaf-like axillary bracteoles lacking basal thickening were also found. These hybrid derivatives of *A. x gustafssoniana* or *A. x taschereaui* would key out wrongly in keys derived from Taschereau, either as *A. prostrata* or *A. glabriuscula*.

### Partially diagnostic characters

Because of extreme variability, my study of the Taschereau collection did not find any *absolutely* diagnostic characters to define *A. x gustafssoniana*



*Atriplex longipes* s.s. Note the elongate trullate leaves and non-spiny, entire edged bracteoles, with very long stalks. Penpoll, Cornwall. Taschereau MANCH collection, 1978.

or *A. x taschereaui* – in other words, there were no characters that occurred only in the one taxon and occurred in all examples of that taxon. There were, however, a good number of *partially diagnostic* characters that did not occur in all examples but which could be used to define a taxon if used in *diagnostic character combinations*. Partially diagnostic characters can be of two types: first, those that, *when they do occur*, are truly diagnostic as they never occur in other taxa; and secondly, characters that are particularly frequent in the taxon concerned, or occur to an extreme degree, but are very infrequent or little developed in other taxa.

### Illustrations

With the exception of those for *Atriplex praecox*, which are redrawn from Taschereau (1985), the drawings are all of Norfolk specimens or selected from the Taschereau MANCH collection of *A. longipes* and its hybrids. For anybody with a



*Atriplex x gustafssoniana* hybrid derivative close to *A. longipes* s.s. Note the elongate triangular-trullate leaves with exaggeratedly long basal lobes. Looe, Cornwall, 1978?. Taschereau MANCH collection, 1978.

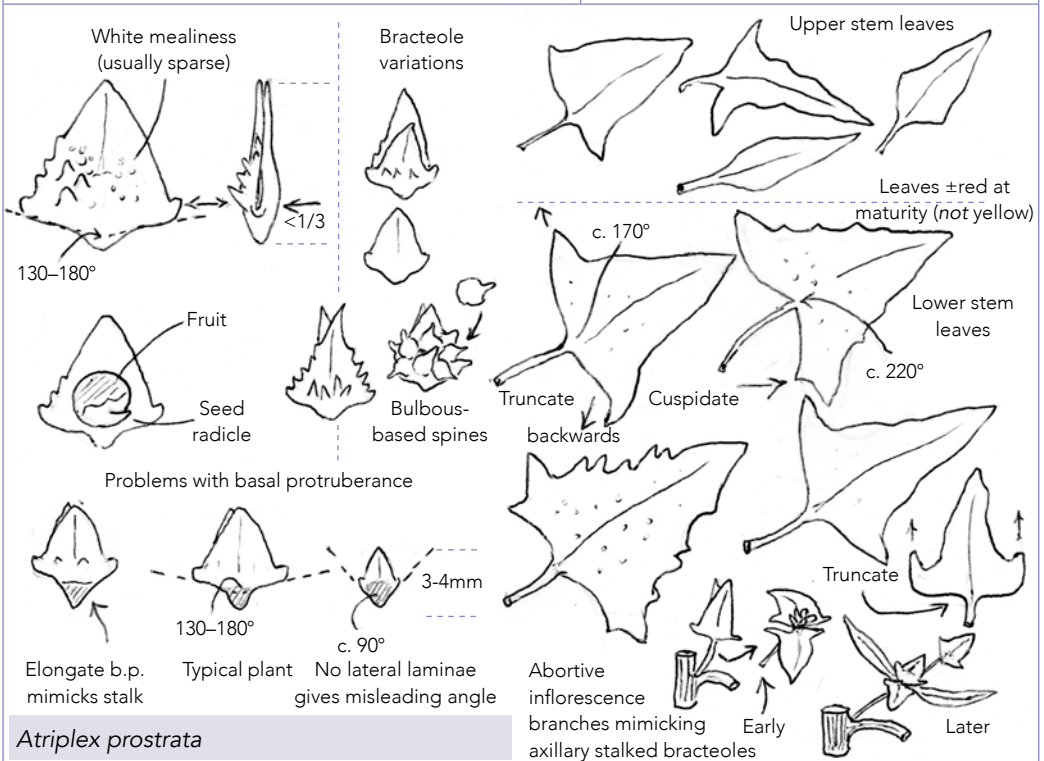
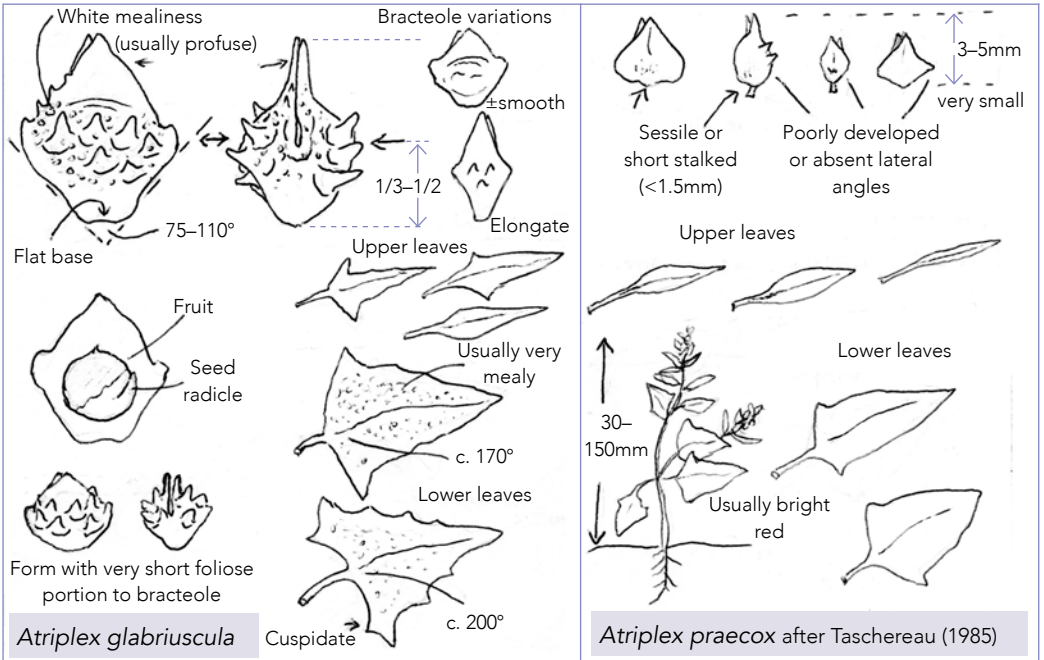
special interest in the *A. longipes* complex, I can supply a full set of drawings from the collection.

### The key

The perennial and alien species of *Atriplex* should immediately be recognised as ‘something different’, and are dealt with in the first half of Stace’s key (Stace, 2010). The key and illustrations given here deal only with the annual native oraches normally encountered, and are designed to supplement the second half of Stace’s key. They allow for identification of simple-leaved forms of *A. patula*, sessile-bracteoled, hybrid derivatives in the *A. longipes* complex, and hybrid derivatives of *A. x taschereaui* with non-spongy bracteoles.

The key and drawings should help botanists to use bracteole characters in the field to better separate the commoner species (especially *A. prostrata/A. patula* and *A. prostrata/A. glabriuscula*). They should also encourage recognition of the *A. longipes* complex; in saline conditions near estuaries or beaches always remember to look for axillary bracteoles, and late in the season (Oct.–Nov.) keep an eye out for plants turning yellow.

<p><i>Atriplex laciniata</i></p>	<p><i>Atriplex littoralis</i></p>
<p><i>Atriplex patula</i></p>	



- Often elongate triangular foliose portion
- Edge entire to subentire
- Some stalks 5–30mm
- Edge straight to slightly convex (± acuminate tip)
- Smooth (no true spines)

**Typical axillary bracteole**

Axillary bracteole variation

Inflorescence branch bracteoles

***Atriplex longipes***

Upper stem leaves

• Succulent  
• Yellow at maturity  
• Elongate triangular-trullate l:b >2.5  
• Often very long basal lobes

Lower stem leaf

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- Usually short triangular foliose portion
- Edge straight to concave
- Often 5mm serrate
- Often spiny
- Stalks usually <math>< 5\text{mm}</math>

**Axillary bracteole variation**

Inflorescence branch bracteoles

- Some plants with typical leaves have all sessile bracteoles
- Lower leaves
- Leaves usually succulent
- Yellow or red at maturity
- Usually elongate-triangular (l:b >2.5)
- Bases cuneate-truncate

Thickened midrib

• Prominent venation  
• Winged pseudostalk

***Atriplex x gustafssoniana***

Upper leaves

• Basal lobes often very long

Lower leaves

• Always short triangular l:b <math>< 1.5</math>  
• c.   
• Basal lobes short

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***Atriplex x taschereaui***

Upper leaves

Lower leaves

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**A key to the annual native *Atriplex* species of the British Isles**

1. **Leaves frosted greenish silver with Krantz venation; stems purplish pink; bracteoles** broadly rhombic, usually wider than long, base broadly cuneate to truncate, **thickened at the base, hard and incompressible (cartilaginous or woody)**, with **prominent, squared-off lateral angles**, most with broad based spines, occasionally smooth; **fruit transversely elliptical**, often with central boss  
 ..... **A. laciniata (Frosted Orache)**  
 Nearly always on sand on the lower beach, often part of the foredune community with *Cakile maritima*, *Salsola kali* and *Elytrigia juncea*, or just below it, less often on the upper beach, or on pebbles or shingle.
1. **Leaves green or greyish green/mealy, not silvery, stems the same (not purple-pink); bracteoles either thickened at base but soft and compressible (spongy), or not thickened at base and leaf-like (herbaceous); fruit orbicular** ..... **2**
2. **Lower- and mid-stem leaves simple, without basal lobes** ..... **3**
2. **Lower- and mid-stem leaves with basal lobes** ..... **4**
3. Always erect or ascending, with bracteoles in broad, cylindrical, and mainly confluent masses; **lower- and mid-stem leaves parallel-sided, linear or linear-oblong**, bases attenuate, edges usually dentate; **bracteoles trullate-ovate, base broadly cuneate (basal angle 105°–125°), always spongy and ‘fat’ from sideview and always profusely spiny**, foliose portion narrowly triangular or tongue-shaped, often recurved at maturity ..... **A. littoralis (Grass-leaved Orache)**  
 Obligate halophyte on upper beach, estuarine silt, or just above saltmarsh; in recent decades frequent to dominant over long stretches of salted major roads.
3. Usually prostrate or ascending, bracteoles more in groups (glomerules); lower- and mid-stem leaves **lanceolate, (not parallel-sided)**, bases cuneate or rounded, usually entire edged; **bracteoles trullate to rhombic (diamond-shaped), base narrowly cuneate (basal angle 75°–110°), never spongy and ‘fat’ from side view, smooth or sparsely spiny**, foliose portion broadly triangular, usually with foliose portions well applied (occasionally foliose portions elongate, leaf-like and recurved). ..... **A. patula (Common Orache)** (simple-leaved form)  
 The most common simple-leaved form of *A. patula* is a strictly procumbent, plate-like plant on consolidated arable land, with numerous main branches radiating outwards horizontally from a main stem only 1–2cm long; this form often produces very long bracteoles (<32mm) with elongate foliose portions (proportion fused around 1/4 rather than 1/3–1/2), and occasionally with stalks up to 5cm.
4. **All bracteoles sessile without true stalks or pseudostalks** ..... **5**
4. **Some bracteoles (usually axillary) with either true stalks or pseudostalks** ..... **9**
5. **Bracteoles thickened at base, appearing ‘fat’ from side view (spongy)** ..... **6**
5. **Bracteoles not thickened at base, thin and leaf-like from side view apart from slight swelling of fruit compartment at base (herbaceous)** ..... **7**
6. **Foliose portion very short (shorter than wide)**, obtuse to subacute tipped; **bracteoles** fairly small (<10cm), **base narrowly cuneate (75°–110°)**, usually with flattened point of attachment; **no prominent central vein or reticulate venation, usually spiny and, if so, short spiny (l:b <3.0); seed radicle arising from lateral base and pointing upwards** ..... **A. glabriuscula (Babington’s Orache)**  
 Obligate halophyte on exposed beaches of sand or shingle, on the upper beach, or just above beach; very infrequent on estuarine sites or salted road verges.
6. **Foliose portion long (as long or longer than wide)**, obtuse to subacute tipped; **bracteoles** fairly large (<17mm), shape and basal angle very variable, seldom with flattened point of attachment; **sometimes**

with prominent central vein and reticulate venation; often smooth, but if spiny usually some bracteoles with elongate spines (l:b 3–6); seed radicle arising from centre or near centre of base and pointing laterally or obliquely upwards . . . . . *A. x taschereaui* (Taschereau's Orache) (hybrid derivative with all sessile bracteoles)

7. Lower- and mid-stem leaves lanceolate to ovate, basal lobes sideways or forwardly directed, bases narrowly cuneate (basal angle <160°); bracteoles trullate to rhombic (diamond-shaped); bases narrowly cuneate (basal angle 75°–110°), smooth or sparsely spiny, foliose portion triangular with straight, subentire edge . . . . . *A. patula*

Wasteground, road verges and especially arable habitats; infrequent on salted road verges; only rarely on or near beaches, or in estuarine habitats.

7. Lower- and mid-stem leaves variously shaped, often with some basal lobes backwardly directed, basal angle variable (often some 160°–220°); bracteoles not diamond-shaped but triangular, triangular-ovate, trullate or trullate-ovate . . . . . 8

8. Lower- and mid-stem leaves yellow or red at maturity, mainly elongate triangular (l:b >2.5), with more or less truncate, but not subcordate, bases, basal lobes often very long, pointing forwards, sideways or backwards; bracteoles often short spiny, triangular to triangular-trullate, foliose portion short triangular, some with concave edges and finely acute, long acuminate tips, often serrate edged . . . . . *A. x gustafssoniana* (Kattegat Orache) (hybrid derivatives with all sessile bracteoles)

8. Lower- and mid-stem leaves sometimes red at maturity (not yellow), short triangular or triangular-ovate (l:b <1.5), with short basal lobes usually pointing sideways or backwards, some with truncate to subcordate bases (basal angle 160°–220°), basal lobes always short; bracteoles, triangular to triangular-ovate, foliose portion broadly triangular, all with markedly convex edges and obtuse to subacute tips, usually serrate edged and with short spines (l:b <3) . . . . . *A. prostrata* (Spear-leaved Orache)

Most widespread taxon on inland ruderal habitats, industrial wasteground and road verges, occurring frequently in salted main roads along with *A. littoralis*; less common than *A. patula* on arable land, but much more common on beaches and estuarine habitats, including the edge of *Phragmites* stands.

9. Very small plants (3–15cm), usually red when mature; lower- and mid-stem leaves all very small, ovate to lanceolate with short, outward pointing basal lobes; bracteoles very small (3–5mm), rhombic ovate or triangular ovate, sessile or with very short stalks (0.5–1.5mm), poorly developed or absent lateral angles, very thin herbaceous or membranous . . . . . *A. praecox* (Early Orache)

Northumberland and west coast of Scotland, including Shetland; recently discovered in north Wales and Ireland (Rees 2018; Green 2018). On lower beach just above *Fucus* zone, mainly on shingle in sheltered inlets of sea, or on sea lochs.

9. Usually large plants (10–90cm), staying green or going yellow or reddish when mature; lower- and mid-stem leaves large, with well-developed basal lobes pointing forwards, sideways or backwards; bracteoles small to very large (4–40mm), with short to very long stalks (0.5–30mm), most with well-developed lateral angles, thickly herbaceous, succulent or spongy in texture . . . . . 10

10. Bracteoles not thickened and spongy at base (herbaceous) . . . . . 11

10. Bracteoles thickened and spongy at base . . . . . 12

11. Tall, sometimes erect, plant (20–90cm), turning yellow at maturity; lower- and mid-stem leaves succulent, some elongate triangular-trullate (l:b >2.5), bases cuneate with well-developed or very long basal lobes pointing sideways or forwards; some axillary bracteoles large or very large (9–25mm), with long or very long stalks (5–25(–30)mm); bracteoles always smooth or muricate (no real



spines), foliose portion triangular or elongate triangular, with straight to slightly convex and entire or subentire edge ..... **A. longipes s.s. (Long-stalked Orache)**

Obligate halophyte; usually estuarine and on silt, either at the high-tide level of the proper river edge, in saltmarsh or in *Phragmites* stands just above the river edge; less often just above coastal saltmarsh; associated with *Phragmites*, *Elytrigia atherica* and, according to Taschereau, *Juncus maritimus* and *Aster trifolium*; in North Wales associated also with *Bolboschoenus maritimus* (Rees 2017).

**11. Tall**, sometimes erect, **yellow** or red at maturity; **lower- and mid-stem leaves succulent, triangular or elongate-triangular (l:b >2.5), bases cuneate to truncate, (basal angle <180°) with often extremely long basal lobes sometimes pointing backwards as well as sideways or forwards; axillary bracteoles short (3.5–10mm) with short stalks (usually <5mm), frequently short spiny (l:b <3), foliose portions short triangular, many with concave edges, and often with long acuminate tips, frequently serrate** ..... **A. x gustafssoniana**

Hybrid derivatives of *A. x taschereaui* with non-spongy bracteoles will key out here: in these forms bracteoles often very large (<40mm); foliose portions all convex edged; usually with either prominent venation, pseudostalking or elongate spines.

Usually on silt, just above saltmarsh, on brackish river banks, or in the edge of estuarine *Phragmites* beds; most commonly associated with *Phragmites*, *Puccinellia maritima*, *Elytrigia atherica*, or (according to Taschereau) *Juncus maritimus*.

**12. Short**, usually prostrate or ascending, plant; **lower- and mid-stem leaves short triangular to triangular-ovate (l:b <1.5), bases broadly cuneate to truncate, basal lobes always short, pointing forwards, sideways or backwards; axillary bracteoles frequently very large (10-20(-40)mm), true stalks short to quite long (0.5–11mm), shape extremely variable even on the same plant (triangular, trullate, rhombic or ovate), foliose portion longer than wide; large bracteoles often have prominent central vein and reticulate venation sometimes with the central vein extending downwards into a winged pseudostalk, smooth or spiny, frequently elongate spiny (l:b >3-6); seed radicle arising from centre or near centre of base and pointing laterally or obliquely upwards** ..... **A. x taschereaui**

Exposed beaches of sand or shingle, often with *A. glabriuscula*, mainly Scotland and north-west England.

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