AMARANTHUS IN BRITAIN

By J. P. M. Brenan

Various species of amaranth are by no means infrequently found in Britain, but except in a few places especially favoured by climate, such as the island of Jersey, they are usually unpredictable in their occurrence and rarely persist from one year to the next. Here and there indeed in southern England a few species, especially *A. retroflexus* and *A. albus*, may become temporarily established, but their hold seems always to be precarious and easily broken. Ripe seed is often lavishly produced, but with our present climate little fear need be felt of any of them becoming noxious weeds, their frequency of occurrence here being generally due to their repeated introduction from sources overseas.

In recent years amaranths have occurred in Britain with increased frequency. To some extent at least this has been due to the greater use on the land of wool-manure, in which seeds of various species of amaranth are very common, and a number of rare and little-known species have appeared in this way. The difficulties encountered in identifying these, and the absence of any adequate revision of the genus in English, have induced me to write some account of the recorded species and to prepare a key to help in identifying them.

The generic name has been variously spelt as *Amaranthus* or *Amarantus*. Although ἀμάραντος (meaning "not withering") was used as a plant-name by classical authors, and the spelling *Amarantus* would be philologically correct, the spelling *Amaranthus* was deliberately used by Linnaeus. In spite of an apparently erroneous attempt by the International Code of Botanical Nomenclature (1952 edition, Article 82, but reversed in the 1956 edition, Article 73) to conserve the spelling *Amarantus*, the spelling *Amaranthus* is nomenclaturally correct, and must not be altered.

Many species of *Amaranthus* are remarkably similar to one another in general appearance. In the past this has led to the widespread use of certain familiar names for species to which they do not belong, and consequent confusion, both nomenclatural and taxonomic. Much of this historical confusion has now been cleared away, but the genus remains a "difficult" one taxonomically, and accurate identification is only possible if the important characters are clearly understood beforehand and carefully interpreted from specimens being actually examined. Unless the student is already familiar with some species at least, careful dissection under a lens of part of an inflorescence is always to be recommended as a preliminary to identification.

With the exception of *A. deflexus*, our species are all annuals and usually weedy in appearance. Like plants of similar habit in other families, amaranths are greatly affected phenotypically by their environment : starved or trampled plants look altogether different from those grown in rich soil. In poor conditions, a species normally nearly a metre high may flower and ripen fruit with a total height of only two or three centimetres. The key provided in this paper must not be relied on too much in dealing with famine victims, and the collector should where possible avoid them. Certain authors have laboriously classified and named these inconstant states : a recent exponent is Priszter, in whose revision of *Amaranthus* in Hungary (Priszter, 1953) many new infraspecific taxa of this sort are made, and excellent illustrations given. Work of this sort is, I consider, misguided, of limited scientific value, and serves unnecessarily to increase the complexity of an already sufficiently difficult genus.

As has already been implied, many of the most significant taxonomic characters of *Amaranthus* are to be found in the inflorescence, the individual flowers, and the fruits. Some more detailed explanation of these may be helpful.

The inflorescence is always compound, composed of basically dichasially cymose units whose ultimate branches are, however, usually monochasial. Upon the axes of these units the flowers are closely arranged, and the units themselves are usually aggregated into very dense inflorescences or partial inflorescences. The general appearance is often a congested mass in which the individual flowers are hard to discern, and whose basically cymose structure is scarcely apparent without careful separation. In general the inflorescences as a whole may be classified into two kinds, which are usually easily recognisable : a terminal panicle whose apical part at least is leafless and often spike-like, or one composed entirely of axillary cymose clusters, the total inflorescence thus appearing leafy to its apex. With the exception of abnormal plants whose normal development has been prevented by starvation, each species usually has an inflorescence of either one sort or the other, and I have employed this easily observed character at an early stage in the key to the species.

Adding to the difficulty in picking out the densely clustered flowers is the presence of bracteoles similar in colour and often in form to the perianth-segments. Each flower is subtended by two bracteoles which are, in the upper part of the inflorescence-unit, unequal in size. The arrangement is complicated by the displacement of bracteoles through adnation to the inflorescence-axes. The size and shape of the longer bracteoles in the inflorescences, and particularly their length relative to the flowers they subtend, are of great importance in distinguishing several species of *Amaranthus*.

The individual flowers are either male or female or, through reduction, sterile. Most of the species recorded in Britain are monoecious, although a group of American species, of which four have occurred in Britain, are dioecious. The monoecious species are normally protandrous. The number, size and shape of the perianth-segments, particularly of the female flowers, are among the most important taxonomic characters employed in the genus. The perianth is persistent even in fruit, and the various features of the individual segments can be easily studied at that stage. This is the more convenient since the fruit itself is often of the utmost importance in identifying the species. A normally thin pericarp encloses a single seed. The pericarp is either indehiscent or irregularly rupturing, or else regularly circumscissile,* and the fruits of each species with which we are concerned here (with the sole exception of *A. spinosus*, which is easily separated from all the others by being spinous) behave constantly in one or the other of these two ways. The surface of the pericarp may be either smooth or muricate, and this also is frequently important. The seeds themselves are generally rather uniform, smooth, black, rarely dark reddish brown, and glossy, and while their size may sometimes be significant they are otherwise of little diagnostic value, although *A. acutilobus* has a distinctively roughened testa.

There is a marked superficial resemblance between *Amaranthus* and the genus *Chenopodium* (Chenopodiaceae), and misidentifications due to this are not infrequent in herbaria. Clapham, Tutin and Warburg (1952, page 1) separate *Amaranthaceae* from *Chenopodiaceae* by the perianth being scarious in the former family and herbaceous in the latter. This character is, however, by no means always easy to assess, and to give some additional guidance here may be helpful. In *Amaranthus* the leaves are invariably entire (neglecting the sometimes crisped or undulate margin and the sometimes emarginate or bilobed apex), while in *Chenopodium* the leaves are only sometimes entire, but are more frequently toothed, sinuate or lobed. The vesicular hairs so characteristic of many species of *Chenopodium* are quite absent in *Amaranthus*, whose hairs when present are of the

*Dehiscing by a transverse slit extending all round the middle of the fruit, so that the top of the pericarp falls away like a lid.

normal slender sort. Circumscissile fruits, so common in *Amaranthus*, are unknown among the species of *Chenopodium* occurring in Britain. Finally, the normally conspicuous bracteoles subtending the flowers of *Amaranthus* are absent in *Chenopodium*.

From time to time various species of *Amaranthus* have been recorded in Britain. In the early decades of this century much British material of the genus was sent, principally due to the energy and perspicacity of Druce, to Thellung, the leading expert on the genus at that time. In particular, all the available rich adventive material from Tweedside, described by Hayward & Druce in the *Adventive Flora of Tweedside* (1919), was seen and named by Thellung. The identifications were careful and accurate, the species involved became clearly understood, and subsequent work on the genus in Britain has benefited from the good tradition so soundly laid down.

It is necessary here also to acknowledge the debt of gratitude which I, and every other student of the genus, must owe to Thellung for his most scholarly and brilliant account of the genus in Ascherson & Graebner (1914). The complicated taxonomic relationships within the genus, the bewildering ranges of variation, and the fiendishly difficult synonymy are all set out with equal competence. There are many most valuable contributions in Ascherson & Graebner's monumental work, but I believe that none will withstand the tests of time and modern research more firmly than the revision of *Amaranthus* by Thellung. In preparing the present paper I have been guided by his wisdom more often than I can remember.

The elaborate account of *Amaranthus* by Dr. P. Aellen for the second edition of Hegi's *Illustrierte Flora von Mitteleuropa* (1959) was published when most of this paper was already complete and I thus had not the benefit of its help when I should have valued it most. It is unquestionably a very valuable contribution to our knowledge of the genus, and the series of figures of fruits and perianths of so many species is a helpful feature not to be found elsewhere. In several instances, however, I have felt it necessary to differ from the nomenclature of this account, for reasons that I hope will appear sufficient.

The key in the present paper to the species of *Amaranthus* recorded in Britain makes no attempt to be "natural" but is designed solely to make an identification with the minimum of trouble. However, the order in which the species are enumerated afterwards is intended to be "natural," and is based on Thellung's account already mentioned.

Some explanation is necessary about the way the relevant literature and synonymy is cited. So thoroughly was this done by Thellung (1914) that, in pre-1914 works, I have usually restricted myself to citing the places of first publication of names and combinations, and, as far as synonyms are concerned, to mentioning only those necessary for understanding work on the genus in Britain and the nomenclature adopted.

As for the literature and names later than 1914, I have followed personal judgement. To give the full bibliography of some widely distributed species would involve citing most of the floras of the world, with no obvious advantage to be gained. I have therefore cited various works which I hope will be useful, either for their relevance to Britain, or for their descriptions or discussions, or for their illustrations. Many competent accounts are no doubt omitted, but I can only plead that enough is as good as a feast.

To the localities also similar considerations apply. It would be of doubtful use to give under each species all the sometimes very numerous British localities in which it has made a fleeting appearance. It is more useful to give an idea of the frequency or rarity with which each species may be expected to occur as an adventive, and this I have endeavoured to do, citing precise localities only for those species which have occurred with us very rarely.

On the Continent a considerable number of interspecific hybrids in *Amaranthus* have been recorded. A complete list of these is given by Priszter (1958, 126-135). So

far I have seen no hybrid amaranths from Britain, although the possibility of their occurrence should be borne in mind. The impermanence of the species here makes it unlikely that hybrids will occur frequently.

ARTIFICIAL KEY TO THE SPECIES OF *AMARANTHUS* RECORDED IN BRITAIN

1a. Axils of stem-leaves mostly bearing paired spines; terminal part of inflorescence spike-like; fruits dehiscent or indehiscent **6. A. spinosus**

1b. Axils of leaves without spines.

2a. Plants dioecious; inflorescence spiciform or paniculate, with leafless terminal part; ♂ flowers with 5 perianth-segments and stamens; ♀ flowers usually without a perianth, or with 1-2 irregular rudimentary or 5 well-developed (in 24. *A. palmeri*) perianth-segments; fruits indehiscent or dehiscent; seeds 0·75-1.25 mm. in diameter, dark reddish-brown.

3a. Perianth-segments of ♀ flowers absent or only 1-2 and rudimentary or lanceolate; bracts 1-3 mm. long; fruits indehiscent or dehiscent; stems and leaves glabrous or almost so.

4a. ♀ flowers usually without a perianth, sometimes with 1-2 irregular rudimentary perianth-segments; fruits indehiscent; bracts 1-1·5 mm. long; perianth-segments of ♂ flowers subequal, with thin non-excurrent midribs. **22. A. tuberculatus**

4b. ♀ flowers with 1-2 narrowly lanceolate segments, the longer about 2 mm. long; fruits circumscissile; bracts 1·5-3 mm. long; perianth-segments of ♂ flowers unequal, the outer longer than the inner, the former with conspicuously excurrent midrib **23. A. tamariscinus**

3b. Perianth-segments of ♀ flowers 5, well-developed, the inner 2-3 mm. long, spathulate, obtuse to emarginate, with green sometimes slightly excurrent midrib, the outer similar, or else longer and acute with the midrib excurrent in a point; bracts 2·5-6 mm. long; fruits circumscissile; perianth-segments of ♂ flowers unequal, the longer outer ones with conspicuously excurrent midribs.

5a. Stem, leaves and flowers glabrous or almost so; sometimes some pubescence on the very young stems; perianth-segments of ♀ flowers unequal, the inner 2-2·5 mm. long and spathulate, the outer one 3-4 mm. long and acute; bracts 4-6 mm. long **24. A. palmeri**

5b. Stem and leaves beneath ± strongly pubescent; lower surface of leaves minutely glandular; bracts and sometimes perianth minutely ± glandular-pubescent outside; perianth-segments of ♀ flowers subequal, 2-2·5 mm. long, broadly spathulate, with strong green midrib; bracts 2·5-3·5 mm. long. **25. A. watsonii**

2b. Plants monoecious; ♂ flowers with 2-5 perianth-segments and stamens; ♀ flowers with a well-developed perianth of 2-5 segments; fruits various.

6a. Inflorescence (of normally grown plants) forming a terminal panicle, whose apical part, at least, is leafless and often spike-like; ♂ and ♀ flowers usually with 5 perianth-segments (2-3 in 15. *A. deflexus*, 16. *A. lividus* and 17. *A. viridis*).

7a. Inflorescence pendulous, tail-like and normally red; perianth-segments of ♀ flowers obovate or spathulate, imbricate; style-branches recurved. **1. A. caudatus**

7b. Inflorescence erect or suberect, rarely somewhat drooping, red to green; perianth-segments of ♀ flowers not imbricate (except often in 19. *A. standleyanus*).

8a. Fruits circumscissile.

9a. Perianth-segments of ♀ flowers lanceolate to narrowly ovate or elliptic, normally ± acute at apex; style-branches erect; stem subglabrous to somewhat pubescent (less so than in 5. *A. retroflexus*).

10a. Longer bracteoles of the ♀ flowers mostly twice as long as the ♀ perianth. **2. A. hybridus** subsp. **hybridus**

10b. Longer bracteoles of the ♀ flowers mostly as long as to 1½ times as long as the ♀ perianth.

11a. Inflorescence green **2. A. hybridus** subsp. **incurvatus** var. **incurvatus**

11b. Inflorescence red **2. A. hybridus** subsp. **incurvatus** var. **cruentus**

10c. Longer bracteoles of ♀ flowers shorter than the ♀ perianth **2. A. hybridus** subsp. **celosioides**

9b. Perianth-segments of ♀ flowers enlarged above, ± spathulate, obtuse to truncate.

12a. Stems puberulous to subglabrous or glabrous; perianth-segments of ♀ flowers with green midrib excurrent at apex.

13a. Inflorescence with lateral branches very numerous, close, and ± elongate (more than 1 cm. long), forming a dense thick panicle; bracteoles linear, 1½-1½ times as long as the ♂ flowers; ♀ perianth-segments about 2 mm. long, with green midrib not broadened at or above middle, otherwise scarious; dried inflorescences, at least when young, with a characteristic pale glossy brownish tinge. **4. A. quitensis**

13b. Inflorescence with lateral branches very short, appearing glomerate, arranged along the elongate main axes of the inflorescence, which thus as a whole appears rather lax and slender; bracteoles half as long as the ♂ flowers; ♀ perianth-segments very spathulate, about 3-4 mm. long, with a green midrib much broadened and with little branches in middle and upper part of perianth-segment; apex of ♀ perianth-segments spinulose; dried inflorescences without any brownish tinge when young. **21. A. clementii**

12b. Stems densely and shortly woolly-pubescent; perianth-segments of ♀ flowers with midrib disappearing below apex.

14a. Longer bracteoles of ♀ flowers about twice as long as the flowers.

15a. Stems and inflorescence pale green **5. A. retroflexus** var. **retroflexus**

15b. Stems, and often inflorescence also, ± red-tinged. **5. A. retroflexus** var. **retroflexus** subvar. **rubricaulis**

14b. Longer bracteoles of the ♀ flowers about 1½-1½ times as long as the flowers **5. A. retroflexus** var. **delilei**

8b. Fruits not circumscissile.

16a. Longer bracteoles of the ♀ flowers about twice as long as the flowers; perianth-segments of ♀ flowers 5, oblong-lanceolate to somewhat oblanceolate, very acute, slightly unequal, shorter ones about equalling fruit, longer ones slightly exceeding it; fruit smooth or nearly so; seeds about 0·8-1·25 mm. in diameter, smooth and glossy. **3. A. bouchonii**

16b. Longer bracteoles of the ♀ flowers about ½-¾ as long as the flowers; perianth-segments of ♀ flowers 3-5.

17a. Perianth-segments of ♀ flowers 3.

18a. Fruit shorter than or as long as the ♀ perianth, muricate. **17. A. viridis**

18b. Fruit 1½-2 times as long as the ♀ perianth, smooth or somewhat wrinkled.

19a. Leaves acute; stems puberulous above; fruits twice as long as ♀ perianth, inflated, smooth; seed much smaller than the cavity within the fruit, rounded-obovoid about 1-1·2 mm. long. **15. A. deflexus**

19b. Leaves emarginate or subtruncate; stems glabrous; fruit 1½ times as long as the ♀ perianth; seed almost filling the cavity within the fruit, 1-1·2 mm. in diameter.

20a. Fruit 1·5 mm. long; perianth-segments of ♀ flowers obtuse **16. A. lividus** subsp. **polygonoides**

20b. Fruit 2-2·5 mm. long; perianth-segments of ♀ flowers often acute. **16. A. lividus** subsp. **lividus**

17b. Perianth-segments of ♀ flowers 5, unguiculate, claw erect, limb rounded and ultimately spreading. **19. A. standleyanus**

6b. Inflorescence composed entirely of axillary cymose clusters, the stems thus appearing leafy to apices; ♂ and ♀ flowers often with 3 perianth-segments (4-5 in 8. *A. acutilobus*, 10. *A. blitoides*, 18. *A. crispus* and 19. *A. standleyanus*).

21a. Leaves conspicuously emarginate or bilobed at apex; fruit indehiscent.

22a. Larger bracteoles of the ♀ flowers twice as long as the flowers, with spinescent tips; perianth-segments of the ♀ flowers usually 4; fruit 1·25-1·5 mm. long, smooth; seed circular and lenticular, minutely and densely muricate-roughened; leaves obovate-cordate **8. A. acutilobus**

22b. Larger bracteoles of the ♀ flowers as long as the flowers; perianth-segments of the ♀ flowers 3; fruit 3.5-4 mm. long, strongly wrinkled below; seed obovoid; leaves ovate-rhombic, elliptic, or slightly obovate **14. A. macrocarpus**

12a. Stems puberulous to subglabrous or glabrous; perianth-segments of ♀ flowers with green midrib excurrent at apex.

13a. Inflorescence with lateral branches very numerous, close, and ± elongate (more than 1 cm. long), forming a dense thick panicle; bracteoles linear, 1½-1½ times as long as the ♂ flowers; ♀ perianth-segments about 2 mm. long, with green midrib not broadened at or above middle, otherwise scarious; dried inflorescences, at least when young, with a characteristic pale glossy brownish tinge. **4. A. quitensis**

13b. Inflorescence with lateral branches very short, appearing glomerate, arranged along the elongate main axes of the inflorescence, which thus as a whole appears rather lax and slender; bracteoles half as long as the ♂ flowers; ♀ perianth-segments very spathulate, about 3-4 mm. long, with a green midrib much broadened and with little branches in middle and upper part of perianth-segment; apex of ♀ perianth-segments spinulose; dried inflorescences without any brownish tinge when young. **21. A. clementii**

12b. Stems densely and shortly woolly-pubescent; perianth-segments of ♀ flowers with midrib disappearing below apex.

14a. Longer bracteoles of ♀ flowers about twice as long as the flowers.

15a. Stems and inflorescence pale green **5. A. retroflexus** var. **retroflexus**

15b. Stems, and often inflorescence also, ± red-tinged. **5. A. retroflexus** var. **retroflexus** subvar. **rubricaulis**

14b. Longer bracteoles of the ♀ flowers about 1½-1½ times as long as the flowers **5. A. retroflexus** var. **delilei**

8b. Fruits not circumscissile.

16a. Longer bracteoles of the ♀ flowers about twice as long as the flowers; perianth-segments of ♀ flowers 5, oblong-lanceolate to somewhat oblanceolate, very acute, slightly unequal, shorter ones about equalling fruit, longer ones slightly exceeding it; fruit smooth or nearly so; seeds about 0·8-1·25 mm. in diameter, smooth and glossy. **3. A. bouchonii**

16b. Longer bracteoles of the ♀ flowers about ⅓-⅔ as long as the flowers; perianth-segments of ♀ flowers 3-5.

17a. Perianth-segments of ♀ flowers 3.

18a. Fruit shorter than or as long as the ♀ perianth, muricate. **17. A. viridis**

18b. Fruit 1½-2 times as long as the ♀ perianth, smooth or somewhat wrinkled.

19a. Leaves acute; stems puberulous above; fruits twice as long as ♀ perianth, inflated, smooth; seed much smaller than the cavity within the fruit, rounded-obovoid about 1-1·2 mm. long. **15. A. deflexus**

19b. Leaves emarginate or subtruncate; stems glabrous; fruit 1½ times as long as the ♀ perianth; seed almost filling the cavity within the fruit, 1-1·2 mm. in diameter.

20a. Fruit 1·5 mm. long; perianth-segments of ♀ flowers obtuse **16. A. lividus** subsp. **polygonoides**

20b. Fruit 2-2·5 mm. long; perianth-segments of ♀ flowers often acute. **16. A. lividus** subsp. **lividus**

17b. Perianth-segments of ♀ flowers 5, unguiculate, claw erect, limb rounded and ultimately spreading. **19. A. standleyanus**

6b. Inflorescence composed entirely of axillary cymose clusters, the stems thus appearing leafy to apices; ♂ and ♀ flowers often with 3 perianth-segments (4-5 in 8. *A. acutilobus*, 10. *A. blitoides*, 18. *A. crispus* and 19. *A. standleyanus*).

21a. Leaves conspicuously emarginate or bilobed at apex; fruit indehiscent.

22a. Larger bracteoles of the ♀ flowers twice as long as the flowers, with spinescent tips; perianth-segments of the ♀ flowers usually 4; fruit 1·25-1·5 mm. long, smooth; seed circular and lenticular, minutely and densely muricate-roughened; leaves obovate-cordate **8. A. acutilobus**

22b. Larger bracteoles of the ♀ flowers as long as the flowers; perianth-segments of the ♀ flowers 3; fruit 3.5-4 mm. long, strongly wrinkled below; seed obovoid; leaves ovate-rhombic, elliptic, or slightly obovate **14. A. macrocarpus**

21b. Leaves not or scarcely emarginate or bilobed at apex.

23a. Bracteoles twice as long as the ♀ flowers, spinescent; perianth-segments of ♀ flowers 3, not spathulate; fruit circumscissile; plant with main stem erect or ascending; leaves spathulate.

24a. Plant without any red pigment. **9. A. albus** subvar. **albus**

24b. Plant, or at least the stem, ± tinged with red. **9. A. albus** subvar. **rubicundus**

23b. Bracteoles half as long as to scarcely longer than the ♀ flowers (in 20. *A. mitchellii*, to about 1½ times the length of the very spathulate ♀ perianth-segments).

25a. Perianth-segments of ♀ flowers 3, with a slender usually colourless mucro 0·75-1·5 mm. long at apex and often bent outwards; midrib green, narrow.

26a. Leaves unspotted above. **7. A. thunbergii** f. **thunbergii**

26b. Leaves with a reddish blotch on upper side in centre. **7. A. thunbergii** f. **maculatus**

25b. Perianth-segments of ♀ flowers 3-5, with a mucro up to 0·5 mm. long or none (in 12. *A. dinteri* with a spinescent tip up to 0·75 mm. long but with the apical part of the segment composed almost entirely of the strong green midrib; in 20. *A. mitchellii*, with a tip of similar length to the 5 very spathulate segments).

27a. Fruit indehiscent; perianth-segments of ♀ flowers 5, markedly spathulate.

28a. Perianth-segments of ♀ flowers narrowly spathulate, erect, appressed to the fruit; leaves 0·6-1·5 cm. long, undulate-crenate on margins. **18. A. crispus**

28b. Perianth-segments of ♀ flowers unguiculate, claw erect, limb rounded, finally bent outwards and spreading round fruit; leaves 1·5-5 cm. long, ± flat and entire on margins.

29a. Midrib of ♀ perianth-segments green, single, narrow; leaves rhombic-ovate; fruits wrinkled but not longitudinally ribbed. **19. A. standleyanus**

29b. Midrib of ♀ perianth-segments in the broadened part of the segment much broadened and branched, forming a green patch on the segment; fruits longitudinally ribbed. **20. A. mitchellii**

27b. Fruit circumscissile; perianth-segments of ♀ flowers 3-5, not spathulate.

30a. Perianth exceeding the fruit.

31a. Perianth-segments of ♀ flowers 4-5, not hooked or bent outwards; seeds 1·3-1·8 mm. in diameter; plant prostrate. **10. A. blitoides**

31b. Perianth-segments of ♀ flowers 3; seeds 1-1·25 (-1·5) mm. in diameter.

32a. ♀ flowers with 3 unequal perianth-segments, 2 (sometimes 1) of which are broadly spathulate with apex entirely green and foliaceous, the third segment smaller, narrower and entirely whitish-membranous except for a trace of green midrib near apex. **11. A. capensis**

32b. ♀ flowers with 3 similar perianth-segments which are ovate-lanceolate, membranous at base, green and rigid-looking above (due to thickened midrib) with branching lateral nerves and white margin; apex bent outwards in a hook. **12. A. dinteri** var. **uncinatus**

30b. Perianth shorter than fruit; ♀ perianth-segments 3, white with green midrib, with a short apical mucro scarcely 0·25 mm. long.

33a. Leaves oblong or obovate- to linear-lanceolate **13. A. graecizans** ssp. **graecizans**

33b. Leaves elliptic to rhombic-elliptic **13. A. graecizans** ssp. **sylvestris**

1. AMARANTHUS CAUDATUS L. 1753, 990; Thellung, 1914, 231; Sauer,1950, 602, fig. 5 (p. 598); Kloos, 1953, 310; Priszter, 1953, 130, t. 17, fig. 25a (p. 181); Aellen, 1959, 478, fig. 203a-e (p. 468), fig. 239 (p. 478).
[*Amaranthus cruentus* sensu McClintock (1957); *non* L.].

A. caudatus is easily recognised on account of its long tail-like inflorescences, normally of a vivid amaranth-purple.

A. caudatus is extensively cultivated in tropical and temperate regions, but its native home is uncertain. Thellung (1914, 232) suggested an origin in tropical Africa and Asia.

In Britain it is a well-known garden plant and popularly known as Love Lies Bleeding. It is found as an occasional alien on rubbish-tips, probably always of garden origin.

The specimen No. 1117.26 in the Linnaean Herbarium exactly agrees with the species as usually interpreted.

2. AMARANTHUS HYBRIDUS L. 1753, 990; Thellung, 1914, 234; Sauer, 1950, 608, Fig. 6, (p. 605); Kloos, 1953, 311; Priszter, 1953, 134; McClintock, 1957, 7.

subsp. HYBRIDUS

Amaranthus hybridus L., 1753, 990, sensu stricto.

Amaranthus hypochondriacus L., 1753, 991, as " *hypocondriacus* "; Jovet, 1940, 362; Priszter, 1953, 145, t. 17, fig. 25e (p. 181); Jovet, 1957, 97-8, fig. 23h.

Amaranthus chlorostachys Willd., 1790, 34, t. X, fig. 19; Hayward & Druce, 1919, 179, fig. 55 (p. 180); Priszter, 1953, 135, t. 17, fig. 25b (p. 181); Aellen, 1959, 480, fig. 205 (p. 469).

Amaranthus hybridus L. subsp. *hypochondriacus* (L.) Thell., 1912, 204.

Amaranthus hybridus L. var. *hypochondriacus* (L.) Robinson, 1908, 32; Covas, 1941, 336, fig. 3 C-D (p. 335).

Amaranthus hybridus L. subsp. *hypochondriacus* (L.) Thell. var. *chlorostachys* (Willd.) Thell., 1912, 205; Kloos, 1953, 314, photo 13 (p. 313).

Amaranthus hybridus L. subsp. *hypochondriacus* (L.) Thell. "proles" *chlorostachys* (Willd.) Thell., 1914, 236.

A. hybridus subsp. *hybridus* includes, according to Thellung's treatment (1912), two main varieties whose rank he changed in 1914 to that of " proles." One of these has green inflorescences, the other red (or rarely yellow). The variant with green inflorescences is typical *hybridus*, according to the specimen in the Linnaean Herbarium No. 1117.19, and corresponds also with *A. chlorostachys* Willd. The variant with red inflorescences should be called *A. hybridus* L. subsp. *hybridus* var. *erythrostachys* Moq., 1849, 259; Kloos, 1953, 314. [*A. hypochondriacus* L., 1753, 991, *sensu stricto*; *A. hybridus* subsp. *hypochondriacus* (L.) Thell. " proles " *erythrostachys* (Moq.) Thell., 1914, 241; *A. chlorostachys* Willd. var. *erythrostachys* (Moq.) Aell., 1959, 482].

A. hybridus subsp. *hybridus* var. *erythrostachys* is so far unrecorded for Britain, although it may very well occur. The var. *hybridus*, on the other hand, more familiarly known as *A. chlorostachys*, is one of our most frequently occurring amaranths, particularly common as an introduction in wool-manure, and also doubtless introduced by other means.

Within the ambit of var. *hybridus*, there are some minor variations on record for Britain : *A. hybridus* L. var. *pseudo-retroflexus* (Thell.) Thell. [*A. chlorostachys* Willd. var. *pseudo-retroflexus* Thell., 1907, 443; Hayward & Druce, 1919, 181; *A. hybridus* L. subsp. *hypochondriacus* (L.) Thell. var. *pseudo-retroflexus* (Thell.) Thell., 1914, 239; *A. hybridus* L. subsp. *hypochondriacus* (L) Thell. var. *chlorostachys* (Willd.) Thell. subvar. *pseudo-retroflexus* (Thell.) Kloos, 1953, 314], the first, has large bracteoles usually 5 mm. or more long, and stout dense inflorescences giving the plant an aspect recalling that of *A. retroflexus* (typical var. *hybridus* having smaller bracteoles about 3-5 mm. long and more slender inflorescences). The var. *pseudo-retroflexus* is on record for Tweedside (Hayward & Druce, 1919, 181); v.c. 6, N. Somerset, Ashton Gate tip, Bristol, 16 Oct. 1934, *C. I. Sandwith*; also from v.c. 12, N. Hants., Itchen Abbas, 18 Sept. 1927, *C. I. Sandwith*; v.c. 17, Surrey, Teddington, 3 Nov. 1928, *A. R. Horwood & E. Milne-Redhead*; and v.c. 18., S. Essex, Hockley, Oct. 1948, *comm. S. T. Jermyn* in *Herb. Kew.* The second minor variant is *A. hybridus* L. var. *pseudo-retroflexus* (Thell.) Thell.

subvar. *aristulatus* Thell., 1914, 240 [*A. chlorostachys* Willd. var. *pseudo-retroflexus* Thell. subvar. *aristulatus* (Thell.) Cryer & Horrell, 1919, 306; *A. chlorostachys* Willd. var. *aristulatus* (Thell.) Hayward & Druce, 1919, 181], which is characterised by having most of the female perianth-segments bearing at their apex " a distinct awn-like point about ½ mm. long." This variant has been recorded for Tweedside (Hayward & Druce, 1919, 181), Bradford, Yorkshire (Cryer & Horrell, 1919, 306) and v.c. 6, N. Somerset, Bristol, Bedminster, 6 Oct. 1922, *C. & N. Sandwith*. Neither of these variants, however, seems to me of much taxonomic significance, or to be more than a mere form of var. *hybridus*. The specimen of *A. hybridus* in the Linnaean Herbarium, No. 1117. 19, exactly agrees with *A. hybridus* L. " proles " *chlorostachys* (Willd.) Thell. var. *genuinus* Thell., as interpreted by Thellung (1914, 238); it is not *pseudo-retroflexus* or *aristulatus*.

A. hybridus subsp. *hybridus* has with us normally green stems. An unimportant colour-variation with the stems and petioles reddish, *A. hybridus* L. subsp. *hybridus* subvar. *rubricaulis* (Moq.) Thell., 1914, 238 [*A. hybridus* L. var. *rubricaulis* Moq., 1849, 259] has been found in England :—

V.c. 11, S. Hants.: Field with wool-shoddy near Fareham, 1939, *R.C.L. Burges* in *Herb. Brenan*; Corporation refuse-dump on N.E. side of Southampton near Bitterne Park adjacent to R. Itchen, 1953, *M. Cole* in *Herb. Kew*.

Amaranthus hybridus var. *hybridus* has a wide distribution in the tropical and temperate regions of the world. It is hard to separate its native and introduced localities, but its real home may well be in the New World.

In Britain *A. hybridus* var. *hybridus* is most likely to be confused with *A. retroflexus*, from which it is usually readily distinguished by the sparser pubescence, the inflorescence running out into ± cylindrical tail-like spikes, and by the non-spathulate female perianth-segments.

subsp. **incurvatus** (Timeroy ex Gren. & Godr.) Brenan, *comb. nov.*

Amaranthus cruentus L., 1759, 1269; v. Sóo, 1927, 350; Sauer, 1950, 601, fig. 5 (p. 598).

Amaranthus hybridus L., subsp. *cruentus* (L.) Thell., 1912, 205.

var. INCURVATUS

Amaranthus patulus Bertol., 1837, 19, t. 2; Priszter 1953, 148, t. 17, fig. 25f (p. 181); Aellen, 1959, 483, fig. 207 (p. 469).

Amaranthus incurvatus Timeroy ex Gren. & Godr., 1846, 8.

Amaranthus patulus Bertol. subsp. *incurvatus* (Timeroy ex Gren. & Godr.) Arc., 1882, 588.

Amaranthus hybridus L. subsp. *cruentus* (L.) Thell. var. *patulus* (Bertol.) Thell., 1912, 206; Kloos, 1953, 315.

Amaranthus hybridus L. subsp. *cruentus* (L.) Thell. " proles " *patulus* (Bertol.) Thell., 1914, 244.

Grenier & Godron's *Flore de France, Prospectus*, in which *Amaranthus incurvatus* was described, is an exceedingly rare work, not in the libraries of the Royal Botanic Gardens Kew, the British Museum (Natural History), or the Linnean Society of London. Thanks to Mr. P. Taylor and the kindness of the authorities of the Conservatoire et Jardin Botaniques at Geneva, a photographic copy of the relevant parts has been made available. Since this contains apparently the only description of the name *Amaranthus incurvatus*, I reproduce it here *verbatim* :—

" *Amarantus incurvatus* Timeroy.—Fleurs pentandres, en grappes denses, fasciculées; bractées *ovales-sétacées, concaves*, doubles du périgone à divisions *oblongues-lancéolées*. Grappes et rameaux *arqués-infléchis* surtout après la floraison. Tige dressée, sillonée, pubescente, simple ou rameuse; feuilles longuement

pétiolées, ovales-rhomboïdales, mucronulées.-Plante d'un vert foncé; à tiges, rameaux et pétioles rougeâtres. Elle se distingue de l'*A. retroflexus* L. par sa teinte, ses grappes arquées-infléchies, ses bractées plus courtes, lancéolées, et non linéaires-rétuses, par ses feuilles plus finement ponctuées en dessous.

Hab. Tigneu, village près de Lyon, en société avec l'*A. retroflexus*. ♀."

var. CRUENTUS Mansf., 1959, 54.

Amaranthus cruentus L., sensu stricto.

Amaranthus paniculatus L., 1763, 1406; Guiton, 1918, 50; Priszter, 1953, 155, t. 17, fig. 25i (p. 181); Aellen, 1959, 484, fig. 208 (p. 469), fig. 239 f-h (p. 478).

Amaranthus speciosus Sims, 1821, t. 2227; Arsène, 1930, 237.

Amaranthus paniculatus L. var. *cruentus* (L.) Moq., 1849, 257.

Amaranthus hybridus L. var. *paniculatus* (L.) Uline & Bray, 1894a, 145 & 1894b, 314.

Amaranthus hybridus L. subsp. *cruentus* (L.) Thell. var. *paniculatus* (L.) Thell., 1912, 205; Kloos, 1953, 315.

Amaranthus hybridus L. subsp. *cruentus* (L.) Thell. " proles " *paniculatus* (L.) Thell., 1914, 247.

The var. *cruentus* (at least as far as Britain is concerned) comprises those variants of subsp. *incurvatus* with red or purple inflorescences. The structure of the inflorescence is, however, decidedly variable. The plant has been much grown in gardens, cultivars have arisen, and a number of them have been given botanical names (see Thellung, 1914, 248-251). There is a specimen of *Amaranthus cruentus* in the Linnaean Herbarium, No. 1117. 25, which may be taken as authentic and has long, stout, flexuous, spiciform inflorescences, and agrees with *A. hybridus* L. subsp. *cruentus* (L.) Thell. " proles " *paniculatus* (L.) Thell. var. *cruentus* (L.) Moq. as interpreted by Thellung (1914, 249), of which *A. speciosus* Sims is given as a synonym. It is closely similar also to *Augustin & Sennen, Plantes d'Espagne*, 3798 (Herb. Kew.), from Spain, prov. Gerona, Figueras, Collège Hispano-Français, 13 Oct. 1919, which is likely to have been from a cultivated plant. *A. paniculatus* L., as judged from the specimen in the Linnaean Herbarium, No. 1117. 20, is very like *A. cruentus* but has densely and profusely branched inflorescences with the lateral branches rather short, slender, and arching upwards.

It is likely that var. *cruentus* is itself a taxon that has arisen in cultivation, but has thus become widely spread, and has escaped in various places.

In Britain it is a rather rare alien of rubbish-tips and waste ground, probably usually originating as a throw-out from gardens. It is possible that it may be more persistent in Jersey.

Although *A. paniculatus* L. var. *sanguineus* Regel (Mar. 1849) antedates var. *cruentus* Moq. (May 1849), the possibly typical form of the former is referred by Thellung to subsp. *hybridus*, others of its forms coming under subsp. *incurvatus*. I consider that *cruentus* should stand.

[subsp. CELOSIOIDES (H.B.K.) Thell., 1914, 251.

Amaranthus celosioides H.B.K., 1818, 194; Sauer, 1950, 608, fig. 6 (p. 604); Aellen, 1959, 483, fig. 206 (p. 469).

This subspecies of *A. hybridus*, outstanding on account of its very short bracteoles, is native of South America, but has not yet been recorded with certainty from Britain though it may well occur].

3. AMARANTHUS BOUCHONII Thell., 1926, 4, as " *bouchoni* "; Jovet, 1940, 365, fig. Bo 1-4 (p. 366); d'Alleizette & Aellen, 1953, 161; Jovet, 1957, 97-8, fig. 23, Bo; Aellen, 1959, 475, fig. 200 (p. 468).

The origin of this species is unknown. It was first described from France, and has become, according to Jovet (1940), locally common especially round Paris (where I have seen it) and to the northwards, and also in south-western France round Bordeaux, Toulouse and Périgueux. It is also in Germany and Switzerland (Aellen, 1959, 475-6).

In Britain the species has been found twice, as follows :—

V.c. 25, E. Suffolk : Brantham, weed on farm, comm. Nov. 1959, *N. R. Kerr* in *Herb. Kew.* V.c. 28, W. Norfolk : arable land, Rowley Corner, Hilborough, in a crop of annual blue lupin, Sept. 1954, *E. L. Swann* 2524.

The Norfolk specimen was distributed through the Exchange Section of the B.S.B.I. wrongly determined, by myself, as *A. hybridus*, subsp. *cruentus* var. *patulus* (see Graham, 1955, 581).

Amaranthus bouchonii is strikingly similar to *A. hybridus* subsp. *hybridus* except for the indehiscence of the fruits. Tucker & Sauer (1958) have discussed certain aberrant populations of amaranths occurring in the Sacramento-San Joaquin Delta in California and involving hybrids between *A. caudatus*, *A. cruentus* (treated by them as a species), *A. hybridus*, *A. powellii* S. Wats. and *A. retroflexus*. They found that in certain plants of these complex populations the fruit often fails to dehisce, although this character is unknown in any of the five species involved. They suggest that *A. bouchonii* represents a genotype of similar hybrid origin occurring in Europe. The abundance and constancy of *A. bouchonii* on the Continent makes this suggestion not altogether convincing. An origin through mutation from *A. hybridus* seems at least an equally likely explanation.

4. AMARANTHUS QUITENSIS H.B.K., 1818, 194; Thellung, 1914, 252; Sauer, 1950, 608, fig. 6 (p. 604); Kloos, 1953, 315; Priszter, 1953, 159, t. 10 (p. 161) t. 17, fig. 25j (p. 181); Aellen, 1959, 487, fig. 210 (p. 470).

Amaranthus hybridus L. var. *quitensis* (H.B.K.) Covas, 1941, 336, fig. 3A-B (p. 335).

A native of South America, occurring from time to time in Britain as a rare alien near docks, on rubbish-tips, and as an introduction with wool-manure.

A. quitensis is similar both to *A. hybridus* subsp. *hybridus* and to *A. retroflexus*, but is distinguished from both by the ♀ perianth-segments and from *A. retroflexus* by the much less hairy stems. It is a late flowerer with us, seldom if ever fruiting. In the dried state the ♂ flowers have a characteristic pale brownish glistening sheen which I have not observed in the related species.

5. AMARANTHUS RETROFLEXUS L., 1753, 991; Thellung, 1914, 254; Hayward & Druce, 1919, 176; Sauer, 1950, 605, fig. 6 (p. 604); Clapham, Tutin & Warburg, 1952, 342; Kloos, 1953, 316; Priszter, 1953, 162, t. 16, fig. 24 b,c (p. 175), t. 17, fig. 25k (p. 181); Aellen, 1959, 485, t. 95, fig. 5, 5a, c-e, fig. 209 (p. 470), fig. 241 (p. 486), fig. 242 1-r (p. 505).

var. RETROFLEXUS; Aellen, 1959, 486.
Amaranthus retroflexus L. var. *genuinus* Thell., 1914, 259.

According to Thellung (1914, 255), probably of North American origin; now common in Europe also, and introduced into other parts of the world.

In Britain it is perhaps our commonest amaranth on rubbish-heaps, near docks, and also as a weed in cultivated ground, sometimes showing a tendency to persist from year to year. As an introduction with wool-manure it seems rather rare. It is normally easily identified by its paniculate terminal inflorescence, lobed but not with " tail-like " branches, by its densely pubescent stems and by its spathulate ♀ perianth-segments.

It is normally green (subvar. *retroflexus*) but a variant with a reddish tinge on the stems and inflorescences (*Amaranthus retroflexus* L. subvar. *rubricaulis* Thell, 1914, 260 ; *Amaranthus retroflexus* var. *rubricaulis* (Thell.) Sandwith, 1953, 414) has been once found :

V.c. 18, S. Essex : Dagenham, *N. Y. Sandwith* 3958.

The specimen No. 1117.22 in the Linnaean Herbarium is certainly the species as usually interpreted. I think that it is almost certainly var. *retroflexus* but the specimen is immature.

var. DELILEI (Richter & Loret) Thell., 1907, 442; Thellung, 1914, 260; Hayward & Druce, 1919, 176; Kloos, 1953, 317; Priszter, 1953, 180, t. 17, fig. 252 (p. 181); Aellen, 1959, 486.

Amaranthus delilei Richter & Loret, 1866, 316.

The var. *delilei* has much the same general distribution as var. *retroflexus*, and is connected with it by some intermediates. In Britain it is somewhat less common than var. *retroflexus* but nevertheless not infrequent. It is separated from var. *retroflexus* only by the shorter bracteoles, as mentioned in the key (p. 265).

6. AMARANTHUS SPINOSUS L., 1753, 991; Thellung, 1914, 267; Kloos, 1953, 317; Aellen, 1959, 477, fig. 202 (p. 468).

A. spinosus, unique among our amaranths in producing paired axillary spines, is a pantropical species rarely seen in Britain and then usually near docks or as an introduction with wool-manure. *A. spinosus* is also remarkable in having the fruits indehiscent or irregularly dehiscent, or regularly circumscissile (? varying on the same plant).

The specimen No. 1117. 27 in the Linnaean Herbarium exactly agrees with this species as usually interpreted.

7. AMARANTHUS THUNBERGII Moq., 1849, 262; Hayward, 1914, 332, *cum tab.*; Thellung, 1914, 280; Hayward & Druce, 1919, 181; Kloos, 1953, 319; McClintock, 1957, 7; Aellen, 1959, 496, fig. 223 (p. 471).

A. thunbergii is indigenous in tropical and South Africa. In Britain it is one of the most frequently occurring amaranths where wool-manure has been used and is rarely introduced through any other means.

The upper surface of the leaves is normally green, but Thellung (1919, 306) described a f. *maculatus*, with the leaves bearing a reddish blotch in their centre. The type-collection was made by J. Cryer at Bradford in Yorkshire, but in recent years the same form has occurred as an occasional introduction with wool-manure in other localities in England.

8. AMARANTHUS ACUTILOBUS Uline & Bray, 1894, 10, 320; Thellung, 1914, 282; Sandwith, 1948, 271; Aellen, 1959, 497, fig. 224 (p. 471).

A. acutilobus is native of southern Mexico, and has with us once been recorded as a casual :—

Channel Isles : Jersey, St. Helier's, 21 Sept. 1920, *Bro. Louis-Arsène.*

The above gathering was distributed through the B.E.C. in 1929 under the erroneous name of *A. ascendens* Lois. var. *polygonoides* (Moq.) Thell. (see Sandwith, *l.c.*).

A. acutilobus is, as Sandwith has pointed out, an outstandingly distinct species, " well characterised by being quite glabrous; by the remarkably small, obcordate and deeply emarginate leaves; the small axillary clusters of flowers; the spinous-tipped outer bracts which are up to twice as long as the female flowers; the 5 tepals of the male and the 4 tepals of the female flowers; and, finally, by the ellipsoid-subglobose fruits which are smooth and indehiscent."

9. AMARANTHUS ALBUS L., 1759, 1268; Thellung, 1914, 283; Hayward & Druce,

1919, 179; Covas, 1941, 337, fig. 3 F-G (p. 335); Clapham, Tutin & Warburg, 1952, 342; Kloos, 1953, 320; Priszter, 1953, 180, t. 38, fig. 56a (p. 232); Aellen, 1959, 497, fig. 225 (p. 471).

A. albus is a native of North America. In Britain it is a frequent introduction on rubbish-tips, near docks, etc., and also occurs as an introduction with wool-manure. On the great rubbish-tips at Dagenham, S. Essex (v.c. 18) it occurred before the last war in immense profusion in certain places, and evidently persisted from year to year.

The specimen in the Linnaan Herbarium, No. 1117.1, exactly agrees with the species as usually interpreted.

A. albus is easily recognised by its conspicuously pale, whitish or straw-coloured, usually much branched stems; by its spathulate leaves; by its axillary inflorescences; by its spinescent bracteoles much longer than the flowers; by the flowers of both sexes having normally 3 perianth-segments; and by the circumscissile fruits.

Normally there is no trace of reddish pigment in the plant, but *A. albus* L. subvar. *rubicundus* Thell., 1914, 287 [*A. albus* L. f. *rubicundus* (Thell.) Priszter, 1953, 190], with a + reddish tinge, has been once found :—

V.c. 28, W. Norfolk : Appleton, carrot-field alien, 1 Oct. 1949, *C. E. Hubbard.*

10. Amaranthus blitoides S. Wats. (1877) 273; Thellung, 1914, 290; Jovet, 1940, 369; Brenan & Sandwith, 1948, 269; Kloos, 1953, 320; Priszter, 1953, 191, t. 38, fig. 56c (p. 232); Aellen, 1959, 489, fig. 214 (p. 470).

A. blitoides is a native of North America, and, though first recorded for Britain as recently as 1948, has occurred rather frequently in recent years, usually on rubbish-tips and waste ground, but also occasionally as a wool-alien.

A. blitoides is closest in appearance to *A. graecizans*, from which it differs in the ♀ perianth-segments equalling or exceeding, not shorter than, the ripe fruit. It differs from *A. thunbergii* in the ♀ perianth-segments being shorter, separated from one another to base and not overlapping, with narrower, less markedly scarious margins and a shorter apical spinule.

11. Amaranthus capensis Thell., 1914, 293; Kloos, 1953, 322; Aellen, 1959, 502, fig. 232 (p. 472).

This rare and little-known species is native of South Africa. Thellung based his species on *Ecklon & Zeyher* 88, but no other South African material, at least at Kew, appears to have been hitherto identified with it. No Ecklon & Zeyher specimen bearing the number 88 has been traced in the herbaria at Zürich, Vienna, Paris, Kew,or Oxford, or in the Gandoger Herbarium at the Faculté des Sciences, Lyon. It is quite likely that the holotype was destroyed at Berlin, but a duplicate may well exist in some herbarium not so far searched. If one is found, the writer would be glad to know. Meanwhile the species must be interpreted from description. The following specimen, issued from the National Herbarium at Pretoria as *A. thunbergii* Moq., agrees well with Thellung's description of *A. capensis* :—

SOUTH AFRICA. Cape Province, Willowmore Division, 9 Nov. 1950, *G. C. Theron* 907 (Herb. Kew.) : –prostrate on sandy soil; leaves slightly succulent.

A. capensis has been collected twice in England, as a wool-alien :—

V.c. 37, Worcs.: Evesham, Charlton, 17 Aug. 1958, *C. W. Bannister* in *Herb. Lousley*, W 780. Same locality, Sept. 1959, *C. W. Bannister.*

A. capensis is evidently related to *A. thunbergii* and *A. dinteri*, but is characterised by two (or sometimes one) of the three ♀ perianth-segments being spathulately enlarged,

green and leafy above, acute to obtuse, with a very short apical spinule scarcely 0·3 mm. long.

12. AMARANTHUS DINTERI Schinz, 1900, 15; Thellung, 1914, 295; Aellen, 1959, 502.

var. UNCINATUS Thell., 1913, 74; Hayward & Druce, 1919, 181, fig. 56 (p. 182); Kloos, 1953, 323; Aellen, 1959, 503, fig. 233 (p. 473).

Amaranthus dinteri Schinz " proles " *uncinatus* (Thell.) Thell., 1914, 296.

A. dinteri is a native of South Africa. *A. dinteri* var. *uncinatus* has occurred in several localities as a wool-alien, though it seems decidedly scarcer than *A. thunbergii*, to which it bears a considerable similarity. The conspicuously hooked, rather rigid-looking apices of the bracteoles and ♀ perianth-segments usually make *A. dinteri* var. *uncinatus* readily separable. Typical *A. dinteri* (var. *dinteri*; *A. dinteri* Schinz " proles " *typicus* Thell. (1914, 296), characterised by its bracteoles and ♀ perianth-segments with their apices straight or only slightly bent outwards, has not so far been found in Britain. Two plants, perhaps best considered as intermediates between var. *dinteri* and var. *uncinatus*, with the apices partially hooked or else less so than in normal var. *uncinatus*, have occurred as follows:

V.c. 37, Worcs.: Charlton, shoddy-field, comm. 3 Nov. 1959, *C. W. Bannister.* V.c. 63, S.W. Yorks.: Linthwaite, 27 Sept. 1959, *D. McClintock in Herb. Lousley* 1117.

13. AMARANTHUS GRAECIZANS L., 1753, 990; Fernandes, 1957, 189-192; Aellen, 1959, 500.

subsp. GRAECIZANS

Amaranthus angustifolius Lam., 1783, 115, *nom. illegit.*; Hayward & Druce, 1919, 177, fig. 54 (p. 178).

Amaranthus angustifolius Lam. " proles " *graecizans* (L.) Thell., 1914, 306.

Amaranthus angustifolius Lam. var. *graecizans* (L.) Thell., 1918, 49.

Amaranthus graecizans L. var. *graecizans*; Aellen, 1959, 501.

A. graecizans subsp. *graecizans*, hitherto usually known under the illegitimate name *A. angustifolius* Lam., seems to be native of the Mediterranean region, tropical Africa, and western Asia. In Britain it is a rather rare alien of rubbish-tips and waste ground.

A. graecizans, of which subsp. *graecizans* is the narrow-leaved race (see the key), is characterised by its axillary inflorescences; by its bracteoles being shorter than the perianth; and by the ♀ perianth-segments being shorter than the fruit.

As Dandy & Melderis have pointed out (Fernandes, 1957, 191), the type in the Linnaean Herbarium (No. 1117.3) agrees with what has been hitherto usually known as *A. angustifolius* Lam.

subsp. **sylvestris** (Vill.) Brenan, *comb. nov.*

Amaranthus sylvestris Vill. (1807) 111; Fernandes, 1957, 192.

Amaranthus graecizans L. var. *sylvestris* (Vill.) Asch., 1867, 176; Briquet, 1910, 471, as " *silvestris* "; Aellen, 1959, 500, fig. 231 (p. 472), fig. 242f, g, s, t, (p. 505).

Amaranthus angustifolius Lam. " proles " *sylvestris* (Vill.) Thell., 1914, 300, as " *silvester.*"

Amaranthus angustifolius Lam. var. *sylvestris* (Vill.) Thell., 1923, 222; Kloos, 1953, 324; Priszter, 1953, 197, t, 26, fig. 41a (p. 203), t. 38, fig. 56d (p. 232).

Amaranthus angustifolius Lam. subsp. *sylvestris* (Vill.) Heukels, 1934.

The geographical range of subsp. *sylvestris*, which is easily distinguished from subsp. *graecizans* by, among other things, its broader leaves, is similar, as is its occurrence in Britain.

Although treated by Fernandes (1957) as a species, I do not find the distinguishing characters given by Thellung (1914) to be sufficiently constant and well-marked to justify that view. Thellung considered *graecizans* and *sylvestris* as " proles " of a single species, which seems nearer the truth. For the above reason also I have been forced to eliminate from the key certain alleged distinctions given by Thellung (1914) : notably the shape of the bracteoles (lanceolate in subsp. *graecizans*, ovate-lanceolate in subsp. *sylvestris*), the form of the midrib of the ♀ perianth-segments (broadened towards apex in subsp. *graecizans*, not or scarcely so in subsp. *sylvestris*), and the shape of the keel of the seeds (usually blunt in subsp. *graecizans*, sharp in subsp. *sylvestris*). I do not find any of these characters sufficiently clear or constant to be of much help in identification.

Amaranthus angustifolius Lam. " proles " *polygonoides* (Moq.) Thell., 1914, 308, similar to subsp. *graecizans*, but with narrow lanceolate and long-pointed ♀ perianth-segments with an apical spinule (0.25-) 0.3-0.75 mm. long (as against 0.25 mm. or less), and bracteoles of similar shape with often even longer points, has not so far been found in Britain, but should be looked for.

14. AMARANTHUS MACROCARPUS Benth., 1870, 216; Thellung, 1914, 311; Aellen, 1959, 499, fig. 230 (p. 472).
Amaranthus macrocarpus Benth. var. *melanocarpus* Thellung, 1914, 311; Kloos, 1953, 325.

A. macrocarpus is a native of Australia. Although Thellung and Kloos have both used the varietal name *melanocarpus*, it is in fact strictly synonymous with typical *macrocarpus* and if a varietal name is used it should be *A. macrocarpus* Benth. var. *macrocarpus*. It has been found only rarely in England, as a wool-alien :—

V.c. 12, N. Hants.: Blackmoor, 24 Oct. 1959, *J. E. Lousley* W 1337. V.c. 37, Worcs.: in cabbage-field, Pinvin, 4 Sept. 1955, *C. M. Goodman* 430 in *Herb. Lousley* W 168. Shoddy field, Evesham, Charlton, Sept. 1959, *C. W. Bannister*, & 21 Sept. 1959, *C. W. Bannister* in *Herb. Lousley* W 986 & 19 Sept. 1959, *C. M. Goodman* 1856 in *Herb. Lousley* W 1039.

A. macrocarpus is outstanding on account of its glabrous stems, emarginate leaves, axillary inflorescences, 3 perianth-segments in both sexes, and elongate fruits 2-3 times as long as the perianth and (in var. *macrocarpus*) blackish when dry.

15. AMARANTHUS DEFLEXUS L., 1771, 295; Thellung, 1914, 313; Covas, 1941, 341, fig. 6 A-F (p. 344); Kloos, 1953, 326; Priszter, 1953, 205, t. 29, fig. 46a (p. 211), t. 38, fig. 56e (p. 232); Aellen, 1959, 504, fig. 235 (p. 473).

A. deflexus is, according to Thellung (1914, 318), South American in origin, but has now become naturalised in North America, the Mediterranean region, and elsewhere. In Britain it is a rather rare alien, especially near docks, and sometimes introduced with wool-manure.

A. deflexus is remarkable among the other species of the genus mentioned in this paper in being a perennial. It is further distinguished by the stems being hairy above, acute leaves, usually partly terminal inflorescences, and by its indehiscent fruits longer than wide, inflated and twice as long as the perianth.

16. AMARANTHUS LIVIDUS L., 1753, 990; Thellung, 1914, 319; Fernandes, 1957, 193; Aellen, 1959, 505, Fig. 236 (p. 473).

subsp. LIVIDUS
Amaranthus blitum L., 1753, 990; Fernandes, 1957, 189-194.

Amaranthus ascendens Lois., 1810, 141; Merrill, 1936, 611; Priszter, 1953, 214, t. 31, fig. 48a (p. 219), t. 38, fig. 56g (p. 232).
Amaranthus blitum L. var. *ascendens* (Lois.) DC., 1813, 4.
Amaranthus lividus L. " proles " *ascendens* (Lois.) Thell., 1914, 321.
Amaranthus lividus L. var. *ascendens* (Lois.) Hayward & Druce, 1919, 177; Thellung, 1923, 223; Covas, 1941, 345, fig. 6 I-J (p. 344); Kloos, 1953, 327, fig. 38 (p. 329); Aellen, 1959, 506, fig. 242 Aa-k, 242B (p. 505).
Amaranthus lividus L. subsp. *ascendens* (Lois.) Heukels, 1934, 169.
Amaranthus ascendens Lois. var. *lividus* (L.) Priszter, 1953, 221.

A. lividus is widespread through the tropics and warmer regions of the world. It is distinguished by being quite glabrous and having normally emarginate leaves, inflorescences usually partly at least terminal, and indehiscent fruits about 1½ times as long as the perianth.

As pointed out by Dandy & Melderis (see Fernandes, 1957), although the type of *Amaranthus blitum* L. in the Linnaean Herbarium (No. 1117.14) is certainly *A. lividus* subsp. *lividus*, the name *A. blitum* has become, owing to repeated misapplication, such a source of confusion and ambiguity that it would be unwise to resurrect it.

Typical *A. lividus* is at present a decidedly rare alien in Britain, usually on rubbish-tips. Judging from the number of old specimens in herbaria, it was more frequent in the nineteenth century than now.

subsp. POLYGONOIDES (Moq.) Probst, 1949, 74.
Euxolus viridis (L.) Moq. var. *polygonoides* Moq. 1859, 274.
Amaranthus ascendens Lois. var. *polygonoides* Thell. ex E. H. L. Krause in " *Mittheil. Philom. Ges. Els.-Lothr.* IV. 3. 1910 S. 372 (1911) " *fide* Thellung, 1914, 320; not seen.
Amaranthus lividus L. " proles " *polygonoides* (Moq.) Thell., 1914, 320.
Amaranthus lividus L. var. *polygonoides* (Moq.) Thell., 1920, 574; Aellen, 1959, 506 (as " var. *polygonoides* (Zollinger) Thell.").
Amaranthus ascendens Lois. subsp. *polygonoides* (Moq.) Priszter, 1953, 221 (as " ssp. *polygonoides* (Zollinger) Thellung, apud E. H. L. Krause . . ."), t. 31, fig. 48a (p. 219).

A. lividus subsp. *polygonoides* is found, according to Thellung (1914) 321, in the tropics of both hemispheres. In Britain it is a very rare alien. In B.E.C. 1919 Rep., 574 (1920), a specimen from " cultivated fields about London, circa 1822, W. Blake, in *Hb. Druce* " was said to have been so identified by Thellung. It has also occurred more recently, as follows :—

V.c. 21, Middlesex : waste ground, Hackney Marshes, 23 Sept. 1913, [*J. E. Cooper*] in *Herb. Kew.* V.c. 34, W. Glos.: Avonmouth Docks, 30 Sept. 1928, *C. I. Sandwith* in *Herb. Sandwith.*

17. AMARANTHUS VIRIDIS L., 1763, 1405.
Amaranthus gracilis Desf., 1804, 43; Thellung, 1914, 335; Covas, 1942, 343, fig. 5 C-D (p. 342); Kloos, 1953, 330; Priszter, 1953, 223, t. 33 (p. 224), t. 38, fig. 56 i (p. 232); Aellen, 1959, 503, Fig. 234 (p. 473).

The nomenclature of this species has been much misunderstood. As Merrill (1935) has pointed out, the type-specimen of *A. viridis* in the Linnaean Herbarium (No. 1117.15) is conspecific with *A. gracilis* Desf.; see also his elaborate paper on the application of the binomial *Amaranthus viridis* L. (Merrill, 1936, 609-612), where there is a photograph

of the Linnaean type (Fig. 2, p. 610).

A. viridis is a pantropical species, occurring as an occasional alien in Britain, introduced with wool-manure and also by other means. It is easily recognised by its partly terminal inflorescences and strongly muricate fruits shorter than, or about as long as, the perianth.

18. AMARANTHUS CRISPUS (Lesp. & Thév.) N. Terracc., 1890, 188; Thellung, 1914, 340; Covas, 1941, 343, fig. 5 C-D (p. 342); Kloos, 1953, 332; Priszter, 1953, 225, t. 38, fig. 56j (p. 232); Aellen, 1959, 491, fig. 217 (p. 471).

Euxolus crispus Lesp. & Thév., 1859, 656.

A. crispus is native of the Argentine, but has been for some time naturalised in southern Europe and locally in the United States. It has been found only once in Britain, as a wool-alien :—

V.c. 37, Worcs.: in crop of beans, Fladbury, 28 Aug. 1958, *C. W. Bannister* in *Herb. Lousley*.

A. crispus is easily recognised by its prostrate stems, small crisped-margined leaves, axillary inflorescences, 5-merous perianths, obovate-spathulate ♀ perianth-segments, and muricate fruits.

19. AMARANTHUS STANDLEYANUS Parodi ex Covas, 1941, 339.

[*Amaranthus vulgatissimus* sens. Thell., 1914, 343, et auct. eur. al., e.g. Kloos, 1953, 333; Aellen, 1959, 493, fig. 219 (p. 471); *non* Spegazz.].

Covas (1941) has pointed out that *Amaranthus vulgatissimus* was misinterpreted by Thellung and has been used in the same wrong sense by authors dealing with adventive plants in Europe. Covas gives the following key :—

Perianth-segments of the ♀ flowers markedly spathulate, with the base markedly attenuate and almost linear and not more than 0·3 mm. wide :	
Leaves undulate-crenate on margin	**A. crispus**
Leaves ± flat and entire on margin	**A. standleyanus**
Perianth-segments of the ♀ flowers oblong-spathulate, with the base somewhat attenuate and more than 0·3 mm. wide	**A. vulgatissimus**

The plant hitherto wrongly known in Britain as *A. vulgatissimus* Spegazz. is in fact *A. standleyanus*, a species from the Argentine. It is a rare alien in Britain, usually near docks or introduced with wool-manure. It is easily distinguished by its flat-margined leaves, usually partly terminal (but sometimes wholly axillary) inflorescences, 5 spathulate ♀ perianth-segments, and indehiscent fruits.

20. AMARANTHUS MITCHELLII Benth., 1870, 214; Aellen, 1959, 493, fig. 220 (p. 471).

This remarkable species, a native of Australia, has been recorded once in Britain, as a wool-adventive :—

V.c. 12, N. Hants.: Blackmoor, 11 Oct. 1959, *J. E. Lousley* W 1331.

It is outstanding on account of its flat-margined, elliptic-lanceolate leaves, entirely axillary inflorescences, 5-merous perianths, and remarkably spathulate ♀ perianth-segments with slender claw and broad spreading lamina, whose green midrib is remarkably broadened and branched in the laminar part so as to form a green patch in the middle of each of the perianth-segments. The fruit is longitudinally ribbed and with smooth swollen style-bases. Altogether it is unmistakably distinct from any of our other species.

21. AMARANTHUS CLEMENTII Domin, 1921, 630.

Amaranthus pallidiflorus F. v. Muell. var. *viridiflorus* Thell., 1928, 60.

[*Amaranthus pallidiflorus sensu* Aellen, 1959, 490 *quoad descr. pro parte et fig.* 215 (p. 470); *non* F. v. Muell.]

A. clementii, although it keys out near *A. quitensis* H.B.K. on account of the leafless apical part of its inflorescence, 5 spathulate ♀ perianth-segments, and circumscissile fruits, is probably not at all closely related to *A. quitensis*. It seems to be akin rather to *A. standleyanus* Parodi ex Covas, from which it is separated by the circumscissile fruits and the remarkable broadening and branching of the green midrib of the ♀ perianth-segments, so that there seems to be a green area in the spathulate part of each segment; also to *A. mitchellii* Benth., which is completely distinct from *A. clementii* in having the inflorescence altogether axillary.

A. clementii is a native of Australia which has occurred once in Britain, as a wool-adventive, as follows :—

V.c. 37, Worcs.: Charlton, 19 Sept. 1959, *C. M. Goodman*, 1859 in *Herb. Lousley* W 1040.

Although Thellung (1928) and Aellen (1959) have treated this plant as a variety of *A. pallidiflorus* F. v. Muell. (1859), the distinguishing characters seem so clear and constant in Australian material that I prefer to accept Domin's opinion of it as a distinct species. The leaves of *A. clementii* are narrow and lanceolate to linear-lanceolate, while those of *A. pallidiflorus* are much broader in relation to their length and mostly elliptic to rhombic-elliptic. Furthermore, the ♀ perianth-segments of *A. pallidiflorus* have a thin green midrib neither branched nor broadened above, and also narrower claws than in *A. clementii*.

22. AMARANTHUS TUBERCULATUS (Moq.) Sauer, 1955, 18; Aellen, 1959, 509.

Acnida tuberculata Moq., 1849, 277.

This species is one of our four alien amaranths which are dioecious. Their distinguishing features are given in the key above. It is a native of the United States, and has been found only rarely in Britain, as follows :—

V.c. 34, W. Glos.: Avonmouth Docks, 12 Oct. 1958 & 20 Sept. 1959, *C. I. & N. Y. Sandwith* in *Herb. Sandwith*; 4 Oct. 1959, *N. Y. Sandwith & D. McClintock* in *Herb. Lousley*.

The 1958 specimen, which like the 1959 one is ♀, has been determined by Dr. Sauer himself.

A. tuberculatus and *A. tamariscinus* have been often placed in a separate genus, *Acnida* L., but Sauer (*l.c.*) has given cogent reasons for not maintaining it. Cytological support for this view is given by Grant (1959).

23. AMARANTHUS TAMARISCINUS Nutt., 1837, 165; Sauer, 1955, 26; Aellen, 1959, 509.

A. tamariscinus, like *A. tuberculatus*, is a dioecious species native of the United States. Like the latter species also, it has been found only rarely in Britain, and strangely enough in the same locality :—

V.c. 34, W. Glos.: Avonmouth Docks, grown on from root collected there on 4 Aug., 14 Sept. 1957, *J. E. Lousley* in *Herb. Lousley*; do., from plant collected there on 31 Aug. 1959, 14 & 28 Oct. 1959, *J. E. Lousley* in *Herb. Lousley*.

The specimens are ♂.

24. AMARANTHUS PALMERI S. Wats., 1877, 274; Sauer, 1955, 31; Aellen, 1959, 509, fig. 237-8 (p. 474).

This remarkable dioecious species is very easily distinguished from its two relatives, *A. tuberculatus* and *A. tamariscinus*, by the well-developed perianth of its ♀ flowers with conspicuously spathulate inner segments, also by the longer bracts. The unusually long petioles, often equalling or exceeding the leaf-blades, are distinctive. It is a native of the United States and Mexico, recorded only in two British localities where, however, it appeared in some plenty at Avonmouth.

V.c. 12, N. Hants.: Alton, a single plant in sidings at railway station where woolshoddy had been unloaded, 18 Oct. 1959, *Miss V. Leather & Miss M. McCallum Webster* in *Herb. Kew.* (♂). V.c. 34, W. Glos.: Avonmouth Docks, 29 Aug. 1959, *Miss M. McCallum Webster*, 2063 (♂), 2064 (♀) in *Herb. Kew.* & 20 Sept. 1959, *C. & N. Sandwith* (♂), 4 Oct. 1959, *N. Y. Sandwith & D. McClintock* in *Herb. Lousley* (♂ & ♀), 11 Oct. 1959, *Mrs. N. Saunders* in *Herb. Lousley* (♂ & ♀).

A plant from Avonmouth (11 Oct. 1959, No. 2068 in *Herb. Kew.*) each of whose leaves has about the middle on the upper side a white mark resembling an inverted V, was collected by Miss McCallum Webster. It is immature, there are no terminal spikes, but a few female flowers in the leaf-axils. I suspect it to be a form of *A. palmeri*, of which it has the general habit and long petioles, but its identity is not certain without more evidence.

25. AMARANTHUS WATSONII Standl., 1914, 505, as "*watsoni*"; Sauer, 1955, 36; Aellen, 1959, 510.

Amaranthus watsonii, yet another of the extraordinary series of dioecious amaranths that has unexpectedly appeared at Avonmouth Docks, Bristol, during the past three years, is clearly more closely related to *A. palmeri* than to other species in this group. It is the only one of our dioecious amaranths with strong pubescence, and its grey-green colour in the field is in strong contrast to the bright green of *A. palmeri*. The other distinguishing features are given in the key. *A. watsonii* is native of Mexico (Baja California and Sonora) and the United States (California and Arizona).

V.c. 34, W. Glos.: Avonmouth Docks, 3 Oct. 1959, *C. & N. Sandwith* (♂ and ♀), 11 Oct. 1959, *Miss McCallum Webster* 2066 in *Herb. Kew.* (♂).

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