

ASPLENIUM

The evolution and genetical relationships (e.g. cytology and enzyme content) in the temperate northern hemisphere species of *Asplenium* are one of the best studied in any group of ferns. The taxonomy of the European species, partially clarified by a study of chromosome numbers and the role of hybridisation, is confused by the plasticity of the leaf morphology, which can be affected by environmental factors and lead to problems of identification, at least between closely related taxa. The following groups can give problems: the *A. adiantum-nigrum* complex, the *A. obovatum* aggregate, and the *A. trichomanes* aggregate.

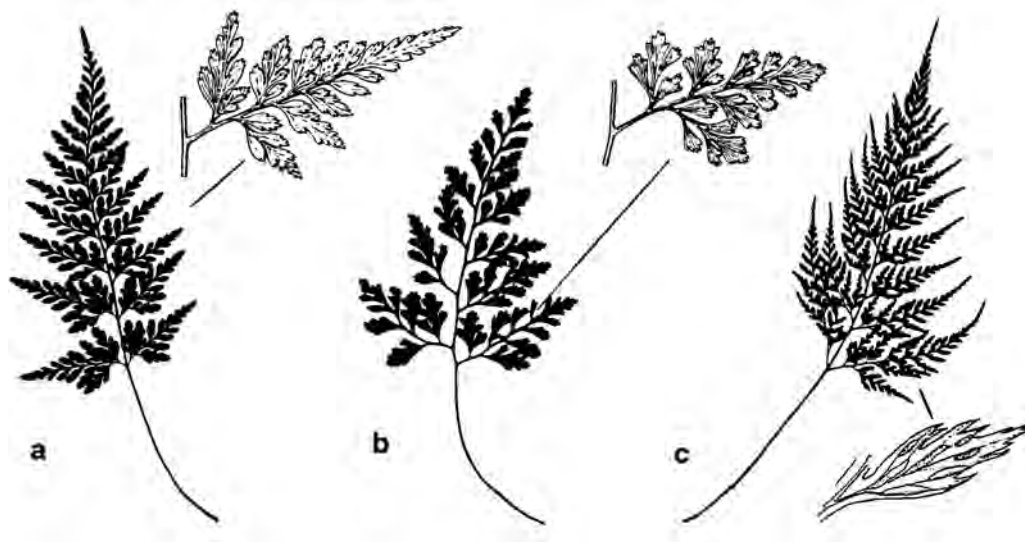
1. *Asplenium adiantum-nigrum* complex

A considerable amount of variation especially in leaf morphology is present within the complex. The tetraploid taxon, *A. adiantum-nigrum*, can be similar to the two diploid parental taxa (*A. cuneifolium* Viv., *A. onopteris*) from which it has evolved. Plants on serpentine, originally thought to be diploid and reported as *A. cuneifolium* (Roberts & Stirling 1974; Jermy *et al.* 1978) have since been shown to be tetraploid (Sleep *et al.* 1978). Vogel *et al.* (1997) using chloroplast DNA techniques elucidated the maternal lineage of the two forms: that with 'cuneifolium' maternal genes [*A. adiantum-nigrum* subsp. *silesiacum* Milde (syn. subsp. *corrunense* (H. Christ) Rivas-Mart.; *et sensu* C. N. Page 1997)]; and that with 'onopteris' maternal genes [*A. adiantum-nigrum* subsp. *adiantum-nigrum*]. The ultimate rank and choice of epithet will not be an easy decision as a number of contending names are available but we suggest they are recorded for the *Atlas* under the subspecies names given above.

The other diploid parent *A. onopteris* is a South Atlantic/Mediterranean plant recorded in the British Isles so far only from Ireland. Some forms of *A. adiantum-nigrum* can look superficially very similar; but the spore size will distinguish them. The hybrid between the two, *A. × ticinense* D.E. Mey., has been recorded with the parents in Cork (Roberts & Scannell 1977) and Kerry (A. Paul, pers. comm.); both are sterile.

	<i>A. adiantum-nigrum</i> L. subsp. <i>adiantum-nigrum</i>	<i>A. adiantum-nigrum</i> subsp. <i>silesiacum</i> Milde	<i>A. onopteris</i> L.
Leaf blade (Figs e-h)	Triangular or triangular-ovate, 2-3 pinnate or 2-pinnatisect, deep mid-green, shiny	Broadly triangular or triangular-ovate, 2-3 pinnate or 2-pinnatisect, deep mid-green, ± dull	Triangular, 3-pinnate or 3-pinnate-pinnatisect, tapering to a caudate apex, fresh mid-green, very shiny
Pinnae	Up to 10 cm long, apex acute to slightly tapered	Up to 5 cm long, apex sub-acute to acute	Up to 12 cm long, tapered to a long-caudate apex
Ultimate segments	Ovate-elliptic to oblanceolate, with convex curved margins narrowed to the base, often deeply cut, apex toothed and acute	Wedge-shaped, base narrowly to broadly cuneate, the margins straight or recurved, toothed at the broadly rounded apex	Narrowly lanceolate, tapered, with an acute apex and teeth
Spores	(21-) 31–37 (-45) µm [mean 34 µm], dark, sooty-brown	(21-) 31–37 (-45) µm [mean 34 µm], mid to dark brown	(21-) 26–31 (-39) µm [mean 28 µm], pale straw

Plant Crib



Leaves of *Asplenium* (a) *A. adiantum-nigrum* subsp. *adiantum-nigrum*, (b) *A. adiantum-nigrum* subsp. *silesiacum*, (c) *A. onopteris*. (Del. R. H. Roberts [a, b] & P. Edwards [c]).

- References**
- Jermy, A. C., Arnold, H. R., Farrell, L. & Perring, F. H. (1978). *Atlas of ferns of the British Isles*. BPS/BSBI, London.
- Page, C. N. (1997). *Ferns of Britain and Ireland*. (Edn 2) Cambridge University Press, Cambridge.
- Roberts, R. H & Scannell, M. J. P. (1977) *Irish Naturalists' Journal* **19**: 75-77.
- Roberts, R. H. & Stirling, A. McG. (1974). *Fern Gazette* **11**: 7-14.
- Sleep, A., Roberts, R. H., Souter, J. I. & Stirling, A. McG. (1978). *Fern Gazette* **11**: 345-348.
- Vogel, J. C., Russell, S. J., Barrett, J. A. & Gibby, M. (1997). Pp. 313-327 in *Pteridology in perspective* (eds Camus *et al.*). Royal Botanic Gardens, Kew.

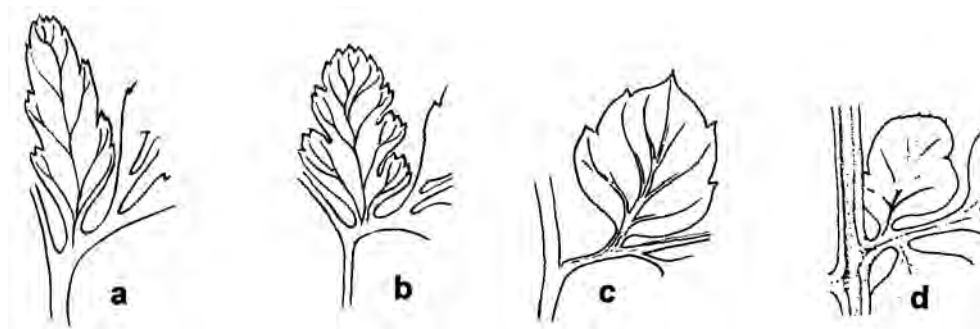
2. *Asplenium adiantum-nigrum* / *A. obovatum*

Asplenium obovatum Viv. subsp. *lanceolatum* (*A. billotii* F. W. Schultz) is an autotetraploid derivative of *A. obovatum* subsp. *obovatum*, a SW European and Mediterranean diploid taxon not yet recorded for the British Isles. The latter tends to be smaller and the leaflets less cut (Fig. d). Young or small plants of subsp. *lanceolatum* may be very similar and it would be difficult to determine without a chromosome count or DNA analysis. Nevertheless, the diploid subspecies may be present in warm habitats on the SW coasts of both Britain and Ireland and suspected plants should be reported.

A. obovatum subsp. *lanceolatum* hybridises with *A. adiantum-nigrum* to form *A. × sarniense* Sleep and has been recorded in the Channel Islands (Sleep & Ryan 1973). It could be expected in Britain and Ireland where the two species grow together. The plants show intermediate morphology (Fig. b); some plants show hybrid vigour, others being lax and somewhat 'scruffy'. The stalked, well-spaced pinnules seen in *A. × sarniense* give the plant a jizz and makes it distinct from either of its parents. For those recording in the spring, a possible hybrid will show green, although often ragged, leaves of last year's growth (a *lanceolatum* character) when the young leaves are unfurling, somewhat earlier than more typical *A. obovatum* is showing signs of growth. In these cases check spores later in the season.

Plant Crib

	<i>A. adiantum-nigrum</i>	<i>A. obovatum</i> Viv. subsp. <i>lanceolatum</i> (Fiori) P. Silva	<i>A. obovatum</i> subsp. <i>obovatum</i>
Habit	Plant rarely with a well-formed rosette but with few leaves	Plants usually forming a compact rosette of many (>15) leaves amongst old persistent leaves & petioles	Plants forming less dense rosettes (up to 6 - 8 leaves)
Leaves	10-25 (-50) cm, triangular or triangular-ovate, 2-3 pinnate or 2-pinnatisect	10-30 cm, lanceolate, 2-pinnate	10-25 cm, lanceolate-oblong, 2-pinnate-pinnatifid
Petiole	Only the swollen base close to rhizome retained when leaf dies	Base not swollen but whole petiole persistent for several years	Base not swollen, usually not persistent when leaf dies
Pinnae (Figs. a, c & d)	Up to 15 pairs, up to 10 cm long, the lowest pair the longest, ± triangular-ovate to broadly trowel-shaped	Up to 20 pairs, up to 7 cm long, the lowest pair shorter than the one above it, linear-lanceolate to oblong, pinnate for most of their length	Up to 12 pairs, up 4 cm long, the lowest pair shorter than the one above it, ovate-triangular, pinnate only in lower half length
Ultimate segments See Figs a-c	Ovate-elliptic to oblanceolate, often deeply cut, acute, not mucronate, not narrowed to a stalk	Oblong with acute mucronate teeth, stalked	Suborbicular, ± crenate, with obtuse or rounded teeth only faintly mucronate, stalked
Sorus	1-3 mm, linear-oblong, closer to the midrib than to the segment margin	1-2 mm, linear-oblong, closer to the margin than the segment midrib	1-2 mm, oblong, closer to the margin than the segment midrib
Exospore length	(21-) 31–37 (-45) μm [mean 34 μm]	(28-) 33– 41 (-49) μm [mean 36 μm]	(22-) 28–32 (-40) μm [mean 30 μm]



Lowest acroscopic pinnules of middle pinna of (a) *Asplenium adiantum-nigrum*, (b) *A. × sarniense* Sleep, (c) *A. obovatum* subsp. *lanceolatum*, (d) *A. obovatum* subsp. *obovatum*. (Del. P. Ryan [a-c], F. Rumsey [d]).

Reference Sleep, A. & Ryan, P. (1973). *La Société Guernesiaise Report & Transactions* 1972: 212-223.

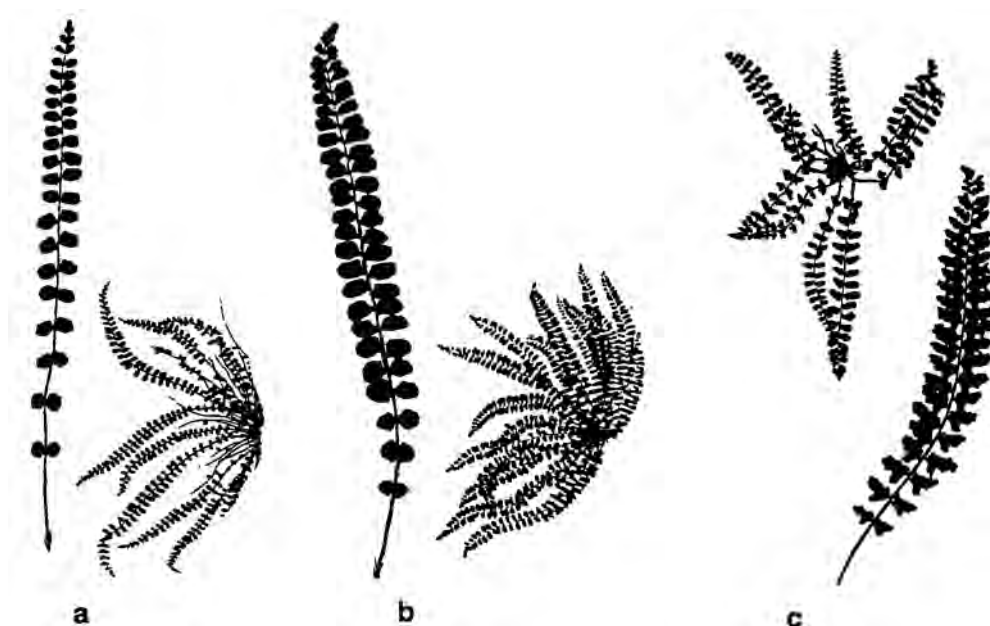
Plant Crib

3. *Asplenium trichomanes* aggregate

This aggregate is represented in the British Isles by a diploid (subsp. *trichomanes*) and two tetraploids (subsp. *quadrivalens* and subsp. *pachyrachis* [*A. csikii* Kümmerle]). In Europe other variations are known, given subspecific rank in *Flora Europaea* (Viane, Jermy & Lovis 1993) but detailed genetical work at the molecular level suggests that these taxa should be accepted at the species level (J. Vogel, pers. comm.). Spore size and stomatal length are helpful to divide the group up to ploidy level.

A species typically found on rock outcrops, ledges and man-made walls, occasionally on hedgerows and banks in deeper soil, both in open and in shade. Macro leaf characters are affected by the micro-environment and make identification difficult (see Lovis 1978). The chemical composition of the rock substrate is important: subsp. *trichomanes* is a definite calcifuge, on acid (i.e. silicious) rocks and on dry stone walls where completely free of mortar; subsp. *quadrivalens* is a calcicole and the common species on walls with mortar, and on limestone, basalt and but sometimes on other rock types that may have only very low calcium content; and subsp. *pachyrachis* is found on limestone and then usually on more vertical faces and in crevices on steeper rocks but also on mortared walls, especially of old castles. The latter subspecies was only recently recorded for Britain (Rickard 1989) and more records may be made. Subsp. *trichomanes* may be under-recorded but the majority of specimens in British and Irish herbaria have been identified by J. D. Lovis as subsp. *quadrivalens*.

The hybrid between subsp. *quadrivalens* and subsp. *pachyrachis* (*A. trichomanes* nothosp. *staufferi* Lovis & Reichst.), and between subsp. *quadrivalens* and subsp. *trichomanes* (*A. trichomanes* nothosp. *lusaticum* (D.E. Mey.) Lawalrée have been recorded and should be looked for where the parents grow together (e.g. on drystone walls with a mortared capping). They often show 'hybrid vigour' and have abortive spores.



Habit and leaves of *Asplenium trichomanes* (a) subsp. *trichomanes*, (b) subsp. *quadrivalens*, (c) subsp. *pachyrachis*.

- References**
- Lovis, J. D. (1978). In Jermy *et al.*, *Atlas of ferns of the British Isles*: 60. BSBI/BPS, London.
 - Rickard, M. H. (1989). *Pteridologist* **1**: 244-248.
 - Viane, R., Jermy, A. C. & Lovis, J. D. (1963). *Flora Europaea* **1** (ed. 2): 18-23. Cambridge University Press, Cambridge.

Plant Crib

	<i>Asplenium trichomanes</i> subsp. <i>trichomanes</i>	Subsp. <i>quadrivalens</i> D.E. Mey. emend. Lovis	Subsp. <i>pachyrachis</i> (H. Christ) Lovis & Reichst.
Stipe	Thin, wiry, glossy, at first black-brown, rapidly becoming bronze-red-brown, persistent long after the pinnae have been shed; not easily broken	Thick, glossy, blackish or dark brown and remaining so throughout the season, eventually becoming dull, often persistent but less so than in ssp. <i>trichomanes</i> , the dead leaf tending to break off just above stipe base; not easily broken	Thick, glossy, blackish or dark brown and remaining so throughout the season, eventually becoming dull, often persistent but less so than in ssp. <i>trichomanes</i> , the dead leaf tending to break off just above stipe base; easily broken
Longest scales	3.5 mm with a central red-brown stripe (see Note 1)	5 mm with a central dark brown stripe (see Note 1)	5 mm with a central dark brown stripe (see Note 1)
Pinnae	Up to 8 mm long, orbicular (in exposed sites) to oval or rhombic and asymmetric (in more sheltered sites), with a distinct stalk, more widely spaced than in subsp. <i>quadrivalens</i> , mostly alternate, those in the upper part obliquely inserted, distinctly longitudinally ridged, often curling under along the wavy margin whilst turning up at the apex; hyaline border absent	Up to 11 mm long, more crowded than in spp. <i>trichomanes</i> (but well separated in shady situations), oblong (even in exposed sites), symmetrical, almost sessile, mostly opposite, with a square insertion, lacking longitudinal ridges, the lateral margins tending to roll under but the apex flat; hyaline border indistinct	Up to 11 mm long, often \pm overlapping (but more separated in shady situations), oblong (even in exposed sites) to subtriangular or even hastate, usually with a distinct auricle on the acroscopic margin, symmetrical, almost sessile or sometimes shortly stalked, alternate at least below, with a square insertion, margin often deeply crenately toothed and wavy; hyaline border \pm conspicuous
Sorus	Up to 2 mm long, 4-6 per pinna	Up to 3 mm long, 4-9(-12) per pinna	Up to 3 mm long, 4-9(-12) per pinna
Indusium	Narrow and delicate	Broad, conspicuous and more persistent than subsp. <i>trichomanes</i>	Broad, conspicuous and more persistent than subsp. <i>quadrivalens</i>
Exospore mean length	(23-) 28-32 (-34) μm (see Note 2)	(26-) 32-38 (-47) μm (see Note 2)	(26-) 32-38 (-50) μm (see Note 2)
Stomata guard-cell	Mean length 32-40 μm (see Note 2)	Mean length 40-48 μm (see Note 2)	Mean length 40-49 μm (see Note 2)

Notes

1. Colour of scales best seen immersed in water or weak glycerin.
2. When measuring spores and stomata guard cells at least 25 should be measured to arrive at the mean.

Authors

A. C. Jermy, F. J. Rumsey & J. C. Vogel, January 1998.