# PTERIDOPHYTES
## FERNS & FERN-ALLIES

A diverse grouping once treated as a single taxon. Herbaceous plants with very varied habit and leaf structure. Homosporous or rarely heterosporous. Sporangia borne either in cones or in groups on normal foliage leaves or on specialised leaves or specialised parts of foliage leaves. Gametophyte of homosporous species usually free living, green and photosynthetic, sometimes subterranean and mycorrhizal; gametophytes of heterosporous species much reduced and retained within spore.

Here divided into 4 informal groups (Lycophytes, Eusporangiate ferns, Calamophytes, Leptosporangiate ferns).

## KEYS TO GENERA OF PTERIDOPHYTES (LYCOPHYTES, CALAMOPHYTES & FERNS)

***General key***

1 Leaves scale-like, in whorls fused into sheath at each node; stems jointed **5/1. EQUISETUM**
1 Leaves not in a fused whorl at each node; stems not jointed 2
2 Plants free-floating on water, with 2-lobed leaves on short stem **9/1. AZOLLA**
2 Plant rooted in solid substratum 3
3 Leaves simple, not lobed or lobed <1/2 way to midrib ***Key A***
3 Leaves compound, or simple and lobed >1/2 way to midrib at least near base (rarely a few ± simple) 4
4 Sporangia borne on leaves or parts of leaves or special branches distinctly different from vegetative leaves ***Key B***
4 Sporangia borne on normal foliage leaves 5
5 Sori on margins of leaves either in protruding indusia or at least partly covered by indusium-like folded-over leaf-margin ***Key C***
5 Sori on underside of leaves, sometimes near margin but then not covered by folded-over leaf-margin ***Key D***

***Key A*** - Leaves simple, not lobed or lobed <1/2 way to midrib

1 Stem a rhizome or stolon, or very short and leaves single or tufted from ground; leaves usually >1cm 2
1 Stem elongated and aerial; leaves <1cm 6
2 Leaves filiform, ≤5mm wide 3
2 Leaves linear to ovate-elliptic, >5mm wide 5
3 Plant rhizomatous; leaves borne singly (often close together) and rolled in flat spiral when young **8/1. PILULARIA**
3 Plant with very short corm-like stem; leaves 1-2 or in a rosette, not rolled in flat spiral when young 4
4 Leaves borne in rosette, with sporangia at base on upperside **3/1. ISOETES**

4 Leaves 1-2; sporangia borne on spike-like special branches **4/1. OPHIOGLOSSUM**

5 Leaves cordate at base, with sporangia borne in linear sori on lowerside **13/1. ASPLENIUM**

5 Leaves cuneate at base; sporangia borne on spike-like special branches **4/1. OPHIOGLOSSUM**

6 Leaves distinctly serrate along most of margin (x10 lens), the youngest ones with minute ligule near base on upperside; heterosporous **2/1. SELAGINELLA**

6 Leaves entire, serrate only at base, or obscurely serrate along margin, without ligule; homosporous 7

7 Stems all ascending to erect, dividing into equal branches; sporangium-bearing leaves not in differentiated cones **1/1. HUPERZIA**

7 Main stems procumbent, with shorter branches; sporangium-bearing leaves in differentiated cones 8

8 Branches flattened, with leaves in 2 alternating, opposite pairs **1/4. DIPHASIASTRUM**

8 Branches not flattened, with leaves borne in whorls, alternately or spirally 9

9 Sterile and sporangium-bearing leaves similar, without either hair-points or scarious margins **1/2. LYCOPODIELLA**

9 Either sterile leaves with hair-points or sporangium-bearing leaves with scarious, toothed margins **1/3. LYCOPODIUM**

***Key B*** - Leaves compound, or simple but lobed >1/2 way to midrib; sporangia borne on leaves or branches that are different from foliage leaves

1 Leaves simple and deeply lobed or 1-pinnate, the lobes or leaflets not or scarcely lobed 2

1 Leaves ≥2-pinnate or 1-pinnate with deeply lobed leaflets 5

2 Stalk from ground bearing 1 pinnate vegetative branch and 1 sporangium-bearing branch **4/2. BOTRYCHIUM**

2 Stalks from ground either a vegetative leaf or a sporangium-bearing leaf 3

3 Sorus-bearing pinnae with distinct flat, green central region, the sori clearly marginal **12/1. PTERIS**

3 Sorus-bearing pinnae without green flat region, or if with one then sori clearly on its lowerside 4

4 Sterile leaves triangular-ovate in outline, <2x as long as wide **17/2. ONOCLEA**

4 Sterile leaves oblanceolate to lanceolate in outline, >3x as long as wide **16/1. BLECHNUM**

5 Stalks from ground each bearing very different vegetative and fertile branches **6/1. OSMUNDA**

5 Stalks from ground either a vegetative leaf or a sporangium-bearing leaf 6

6 Sterile leaves >2-pinnate, finely divided, ± parsley-like 7

6 Sterile leaves regularly 2-pinnate, or 1-pinnate with deeply lobed pinnae 8

7 Perennial with densely scaly rhizome; sori near leaf margin which is folded over to cover it **12/1. CRYPTOGRAMMA**

7 Annual with very short sparsely scaly rhizome; sori on leaf lowerside, not covered **12/2. ANOGRAMMA**

8 Lowest pinna on each side bearing another pinna near its base **12/4. PTERIS**

8 Lowest pinna on each side ± like upper ones, not bearing another

pinna 9
9 Leaves borne singly spaced out along rhizome; fertile leaves green on upperside **14/1. THELYPTERIS**
9 Leaves borne in tufts from apices of branches of rhizome; fertile leaves brown at maturity **17/1. MATTEUCCIA**

***Key C*** - Leaves compound, or simple but lobed >1/2 way to midrib; sporangia borne on edge of normal vegetative leaves

1 Sori a continuous line round margins of pinnules 2
1 Sori few-many discrete groups of sporangia, sometimes close together 3
2 Leaves 1-2-pinnate, tufted, ≤75cm excl. petiole; rhizomes short, scaly **12/4. PTERIS**
2 Leaves (2)3-pinnate, borne singly, ≤2(5)m excl. petiole; rhizomes long, hairy **11/1. PTERIDIUM**
3 Rhizome erect to ascending, trunk-like, >20cm thick, covered with old leaf-bases; some leaves >1m incl. petioles 4
3 Rhizome horizontal, <1cm thick, not covered with leaf-bases; leaves <50cm incl. petioles 5
4 Rhizome (trunk) and petioles with dense hairs **10/1. DICKSONIA**
4 Rhizome (trunk) and petioles with dense scales **9A/-. CYATHEA**
5 Ultimate leaf-segments >5mm wide; indusia formed from folded-under flap of pinnule **12/3. ADIANTUM**
5 Ultimate leaf-segments <5mm wide; indusia formed from tubular or 2-valved protruding outgrowth from pinnule 6
6 Distal part of petiole winged; rhizomes hairy; mature indusia with protruding bristle, tubular **7/2. TRICHOMANES**
6 Petiole not winged; rhizomes glabrous; indusia without protruding bristle, of 2 valves **7/1. HYMENOPHYLLUM**

***Key D*** - Leaves compound, or simple but lobed >1/2 way to midrib; sporangia borne on lowerside of normal vegetative leaves

1 Leaves simple to 1-pinnate with the lobes or pinnae entire to toothed <1/2 way to midrib 2
1 Leaves 1-pinnate with the pinnae divided >1/2 way to midrib, or 2- or more-pinnate 6
2 Sori narrowly elliptic to linear **13/1. ASPLENIUM**
2 Sori circular to very broadly elliptic 3
3 Indusium 0 4
3 Indusium present 5
4 Leaves regularly pinnate or nearly so **19/1. POLYPODIUM**
4 Leaves (on 1 plant) very variably and irregularly pinnately lobed **19/2. PHYMATOSORUS**
5 Pinnae <1.5cm wide, with sori in one row either side of midrib **18/1. POLYSTICHUM**
5 Pinnae >1.5cm wide, with sori distributed ± evenly all over lowerside **18/2. CYRTOMIUM**
6 Sori linear to oblong or C- to V-shaped, >1.5x as long as wide 7
6 Sori orbicular to broadly elliptic-oblong, <1.5x as long as wide 8
7 Sori linear to oblong, with the margin next to midrib straight **13/1. ASPLENIUM**
7 Sori oblong to C- or V-shaped, with the margin next to midrib curved or bent **15/1. ATHYRIUM**
8 Leaves borne singly spaced out along rhizome 9
8 Leaves borne in tufts from apices of branches of rhizome 13

9 Leaves 2-pinnate, or 1-pinnate with the pinnae deeply lobed 10
9 Leaves 3(4)-pinnate, at least at base 11
  10 Pinnae all ± parallel, the longest ones several removed from the basal one; indusium present **14/1. THELYPTERIS**
  10 Lowest pair of pinnae bent back away from plane of others, the longest one the basal or the next to basal; indusium 0 **14/2. PHEGOPTERIS**
11 Indusium 0 **15/2. GYMNOCARPIUM**
11 Indusium present, persistent 12
  12 Rhizome stout, with many dense silky scales; indusium cup-shaped, attached at base and sides **18A/-. DAVALLIA**
  12 Rhizome slender, with few scattered scales; indusium flap- or hood-like, attached at base **15/3. CYSTOPTERIS**
13 Indusium consisting of ring of hairs or narrow scales arching over sorus when young; petiole with joint c.1/3 way from base **15/4. WOODSIA**
13 Indusium 0, vestigial or well developed and membranous; petiole not jointed 14
  14 Indusium a flap-like hood; leaves slender, with few or 0 scales on petiole **15/3. CYSTOPTERIS**
  14 Indusium 0, vestigial or reniform or peltate; leaves often large and with many scales on petiole 15
15 Pinnules with teeth contracted into very fine acuminate apices; indusium peltate **18/1. POLYSTICHUM**
15 Pinnules untoothed or with rounded to acute teeth; indusium 0, vestigial or reniform 16
  16 Sori in rows on pinnules distinctly nearer margin than midrib; fresh leaves with faint lemon scent when crushed **14/3. OREOPTERIS**
  16 Sori either rather scattered on pinnules or in rows no nearer margin than midrib; fresh leaves without lemon scent 17
17 Indusium 0 or vestigial; mountains of Sc **15/1. ATHYRIUM**
17 Indusium oblong to reniform, very obvious; widespread 18
  18 Leaves ≤2.5m, arching and forming plantlets from buds near apex **16/-. WOODWARDIA**
  18 Leaves ≤1.5m, not forming buds or plantlets **18/3. DRYOPTERIS**

# LYCOPHYTES
## CLUBMOSSES & QUILLWORTS

(Lepidophyta, Lycopodineae, Lycopsida, Lycopodiopsida) (families 1-3)

Herbaceous plants with simple or sparingly branched stems and simple leaves with 1 vein; young leaves not spirally coiled. Sporangia homosporous or heterosporous, borne singly in leaf axils or on upperside of leaf near its base, the sporangium-bearing leaves often aggregated into cones. Gametophyte of homosporous species free-living, subterranean, mycorrhizal and saprophytic; gametophytes of heterosporous species much reduced and retained within spore, which lies on the ground.

## 1. LYCOPODIACEAE - *Clubmoss family*

Stems elongated, not, little or considerably branched, bearing roots and leaves without ligules. Homosporous; sporangia in leaf-axils, the sporangium-bearing leaves often differentiated into cones.

Moss-like plants whose leaves have true midribs and stomata.

**1. HUPERZIA** Bernh. - *Fir Clubmoss*
Stems all ascending to erect, dividing into equal, non-flattened branches; leaves spirally arranged, often with bud-like outgrowths in their axils (these effect vegetative propagation); sporangium-bearing leaves not differentiated into cones, similar to sterile leaves.

**1**. **H. selago** (L.) Bernh. ex Schrank & Mart. (*Lycopodium selago* L.) - *Fir Clubmoss*. Stems to 30cm; leaves 4-8mm, patent to appressed, linear-lanceolate to narrowly ovate, entire or nearly so; 2n=>260. Native; heaths, moors, grassy or rocky places on mountains.

**a. Ssp. selago**. Stems to 30cm, 6-12mm thick; leaves linear-lanceolate, ± patent, green when healthy. Common in NW Br S to Wa, rather scattered in Ir, rare and very scattered in lowland Br, formerly locally frequent there.

**b. Ssp. arctica** (Grossh. ex Tolm.) Á. & D. Löve. Stems to 10cm, 5-6mm thick; leaves ovate-lanceolate to narrowly ovate, appressed to stem, yellowish-green even when healthy. Rare in Sc, incl. Orkney and Shetland, exact distribution not known. **RRR**

**2. LYCOPODIELLA** Holub - *Marsh Clubmoss*
Stems procumbent, with non-flattened branches, giving rise to erect, fertile lateral stems; leaves spirally arranged; sporangium-bearing leaves weakly differentiated into apical cones.

**1. L. inundata** (L.) Holub (*Lepidotis inundata* (L.) P. Beauv., *Lycopodium inundatum* L.) - *Marsh Clubmoss*. Procumbent stems dying back quickly behind, to c.20cm; erect stems to 8(10)cm; leaves 4-6mm, erecto-patent, linear to narrowly ovate, entire; sporangium-bearing leaves broader at base; 2n=156. Native; wet heaths, often on bare peaty soil, sometimes submerged; formerly very scattered almost throughout **RR**

Br and Ir, now very local, extinct in C & E En.

**3. LYCOPODIUM** L. - *Clubmosses*
Stems procumbent, with non-flattened branches, with erect sterile and fertile lateral stems; leaves spirally arranged or in whorls; sporangium-bearing leaves well differentiated into apical cones.

1 Leaves acute to acuminate but without long whitish point; cones sessile at apex of leafy stems **3. L. annotinum**
1 Leaves acuminate, with whitish apical point 1.5-4mm; cones usually on sparsely leaved peduncles ≤7(20)cm at apex of leafy stems, rarely sessile 2
2 Peduncles 2.5-7(20)cm; cones (1)2-3(5) on each peduncle **1. L. clavatum**
2 Peduncles 0-1.2(3)cm; cones 1(-2) on each peduncle **2. L. lagopus**

**1. L. clavatum** L. - *Stag's-horn Clubmoss.* Procumbent stems to 1m or more; erect stems to 25cm, leaves 3-5mm, erect to erecto-patent, linear-lanceolate, with apical point 2-4mm, minutely toothed; sporangium-bearing leaves ovate to broadly ovate with long white apical point and scarious toothed margin; 2n=68. Native; heaths, moors, mountains, mostly in grassy places; formerly throughout Br and Ir, now absent from much of lowlands.

**2. L. lagopus** (Laest. ex Hartm.) Zinserl. ex Kusen. – *Hare's-foot Clubmoss*. Differs from *L. clavatum* in erect stems to 10cm; leaves 2.5-3.5mm, with apical point 1.5-3mm but sometimes lost early; and see key (couplet 2). Native; mountain slopes above 800m; 1 locality each in Easterness and Westerness. First reported in 2007. **RRR**

**3. L. annotinum** L. - *Interrupted Clubmoss.* Procumbent stems to 60cm; erect stems to 25cm; leaves 4-10mm, patent to erecto-patent, linear-lanceolate, acute, ± entire; sporangium-bearing leaves ovate, acuminate, with scarious toothed margin; 2n=68. Native; moors and mountains on thin soil over rocks, often among *Calluna*; local in C & N (± entirely mainland) Sc, extinct in S Sc, N En and N Wa except Westmorland (1 site). **RR**

**4. DIPHASIASTRUM** Holub - *Alpine Clubmosses*
Stems procumbent, often ± subterranean, with flattened erect branches arising in fan-like groups; leaves in alternating opposite pairs; sporangium-bearing leaves well differentiated into apical cones.

**1. D. alpinum** (L.) Holub (*D. complanatum* ssp. *alpinum* (L.) Jermy, *Diphasium alpinum* (L.) Rothm., *Lycopodium alpinum* L.) - *Alpine Clubmoss.* Procumbent stems to 50(100)cm; erect branches to 10cm, slightly flattened, glaucous; leaves on erect branches and upperside of procumbent stems 2-4 x c.1mm, entire, appressed, sessile; ventral leaves petiolate, c.0.5mm wide, with >1mm free from stem; lateral leaves fused to stem for c.1/2 their length; cones at apices of normal leafy shoots; 2n=c.48. Native; moors and mountains among grass and *Calluna*, often very exposed; locally common in N & W Br S to Derbys and S Wa, N, E & W Ir.

**2. D. complanatum** (L.) Holub (*Diphasium complanatum* (L.) Rothm., *Lycopodium complanatum* L.) - *Issler's Clubmoss.* Differs from *D. alpinum* in more robust habit; erect branches strongly flattened, scarcely glaucous; ventral leaves sessile, c.1mm wide, with <1mm free from stem; lateral leaves fused to stem for c.2/3 their length; cones at apices of sparsely-leafed peduncles. Native; heaths and lowland moors; formerly very sparsely scattered in C & N Sc and W En, extinct except in few sites in S Northumb, S Aberdeen and W Sutherland. Our plant may be ssp. **issleri** (Rouy) Jermy (*D. issleri* (Rouy) Holub, *Diphasium issleri* (Rouy) Holub), and is probably derived from hybrids with *D. alpinum*. **RRR**

# 2. SELAGINELLACEAE - *Lesser Clubmoss family*

Stems elongated, little or considerably branched, bearing roots on end of special leaf-less branches or on small corm-like swelling at base of stem; leaves serrate, with microscopic outgrowths (ligules) on upperside near base. Heterosporous; sporangia in leaf-axils, the sporangium-bearing leaves in ill- to well-defined cones with megasporangia at base and microsporangia at apex.

Distinguished from Lycopodiaceae in presence of ligule, heterospory, and roots being borne on specialised leaf-less stem-like outgrowths or small corm-like swellings.

**1. SELAGINELLA** P. Beauv. - *Lesser Clubmosses*

**1. S. selaginoides** (L.) P. Beauv. - *Lesser Clubmoss*. Stems decumbent to procumbent, to 15cm, the branches not flattened, bearing erect fertile branches to 6 (10)cm with terminal rather ill-defined cones; roots borne from small corm-like swelling at base of stem; leaves all of 1 sort, 1-3mm, those in cones similar but larger; 2n=18. Native; damp places among moss and short grass on mountains; locally common in NW BI S to W Cork, Cards and NE Yorks.

**2. S. kraussiana** (Kunze) A. Braun - *Krauss's Clubmoss.* Stems procumbent, to 1m, the branches dorsiventrally flattened, bearing well-defined cones increasing in length with age and apparently not terminal; roots borne at ends of special leafless branches; leaves of 2 sorts, 2 rows on upperside of stems c.1-2mm, 2 rows on sides of stems c.2-4mm; cones with 4 closely overlapping rows of leaves; (2n=20). Intrd-natd; grown as ground cover in mild damp regions, ± natd in shrubberies and damp shady places; scattered in BI N to WC Sc, commoner in S & W; Africa.

# 3. ISOETACEAE - *Quillwort family*

Stems short and corm-like, bearing roots at base and a rosette of long, erect, ± subulate leaves with minute ligule on upperside near base. Heterosporous; sporangia ± embedded in leaf-base below ligule; megasporangia produced each year on older leaves, microsporangia on younger ones, the youngest leaves not bearing sporangia.

Similar only to certain angiosperms (notably *Lobelia*, *Littorella*, *Subularia*, *Juncus*); in absence of sporangia the leaves with 4 air-cavities seen in transverse section (only 1 in *I. histrix)* and the peculiar corm-like 2-3-lobed stem are diagnostic.

**1. ISOETES** L. - *Quillworts*

1 Plant only seasonally submerged, with leaves Oct-Jun; leaf-bases dark, shiny, horny, persistent **3. I. histrix**

1 Plant submerged for all or most of year, with leaves Jan-Dec; leaf-bases not dark, shiny and horny, not persistent 2

2 Megaspores 530-700µm across, with blunt, anastomosing tubercles on outer face; leaves stiff, remaining apart when plant removed from water **1. I. lacustris**

2 Megaspores 440-550µm across, with acute spines on all faces; leaves flaccid, falling together when plant removed from water **2. I. echinospora**

**Other spp.** - The amphidiploid derivative of *I. lacustris* x *I. echinospora* (**I. brochonii** Motelay) might also occur, but needs careful research, as does the relation to it of the Irish **I. morei** Moore.

**1. I. lacustris** L. - *Quillwort.* Leaves 8-25(40)cm x 2-5mm, usually ± erect, ± stiff, with 4 longitudinal, septate air canals, parallel-sided for most of length then tapered to acute, often asymmetric point; megaspores 530-700µm across, with blunt anastomosing tubercles; 2n=110. Native; in clear upland lakes, mostly on stony substrata, down to 6m depth; locally frequent in Ir and N & W Br, but absent in En except S Devon and Lake District. **8**

**1 x 2. I. lacustris x I. echinospora = I. x hickeyi** W.C. Taylor & Luebke occurs with both parents in Cards and perhaps W Sutherland; it is intermediate and sterile; 2n=66.

**2. I. echinospora** Durieu (*I. setacea* auct. non Lam.) - *Spring Quillwort*. Leaves 4-15cm x 2-3mm, usually spreading to ± erect, ± flaccid, with 4 longitudinal, septate air canals, tapered to very acute apex from low down; megaspores 440-550µm across, with acute spines; 2n=22. Native; in similar places to *I. lacustris* but rarely with it, mostly on silty substrata; scattered in W Ir and W Br E to Dorset and S Aberdeen. **R 8**

**3. I. histrix** Bory - *Land Quillwort.* Leaves 1-4(10)cm x c.1mm, variously spreading, with 1 longitudinal non-septate air canal, tapered to very acute apex from low down; megaspores 400-560µm across, with blunt tubercles; 2n=20. Native; sandy or peaty hollows on cliff-tops near sea, where water lies in winter; extremely local in Guernsey (first found 1860), Alderney and Lizard Peninsula (W Cornwall) (first found 1919). **RRR**

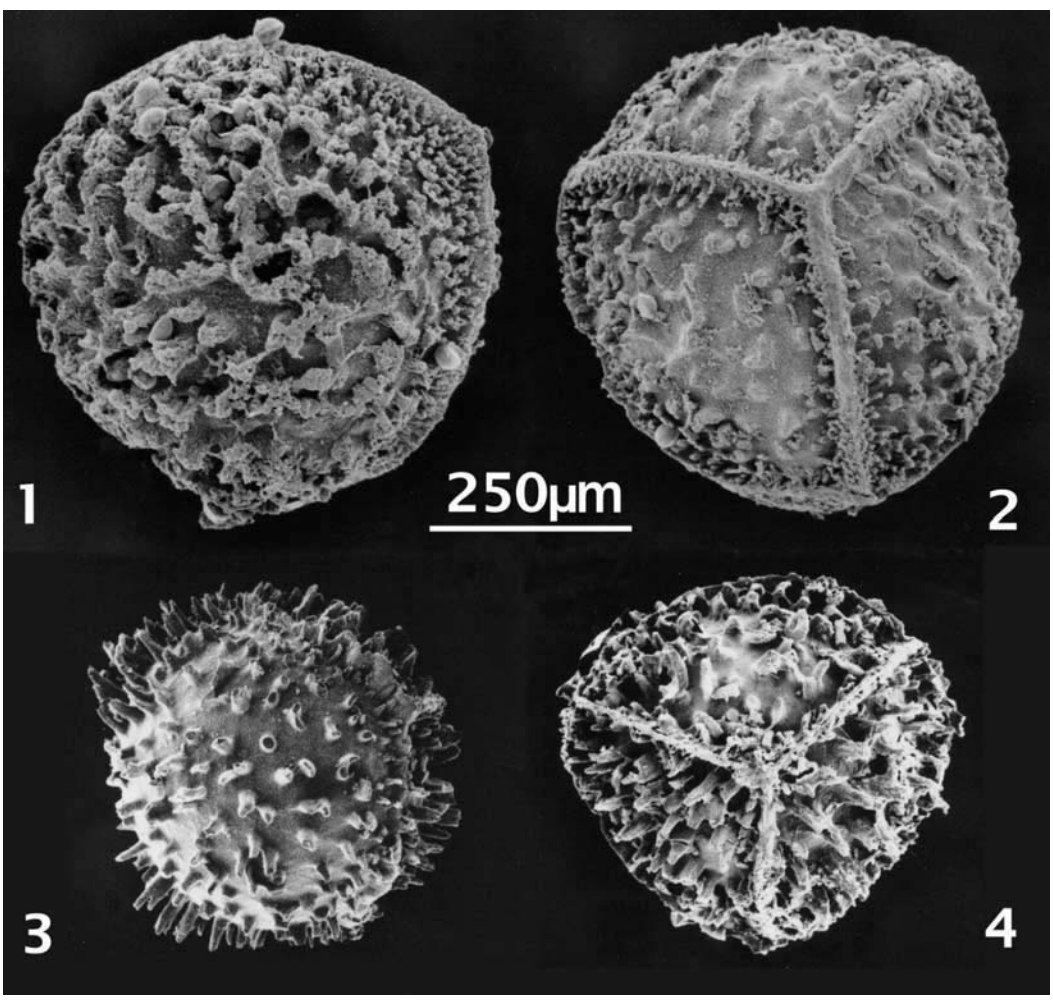


**FIG 8** - ***Isoetes*** megaspores. 1-2, ***I. lacustris***, outer and inner faces. 3-4, ***I. echinospora***, outer and inner faces. Courtesy of A.C. Jermy and Natural History Museum, London.

# EUSPORANGIATE FERNS
## ADDER'S-TONGUES & MOONWORTS
(family 4)

Rhizome short or corm-like, without scales; leaves borne singly, with erect stem-like petiole and sterile blade often plus 1 fertile blade; sterile blade simple and entire or 1-pinnate, not spirally coiled when young; fertile blade a simple or branched spike, the spike or its branches bearing sporangia in a row either side of axis; homosporous; gametophytes non-green, subterranean, with mycorrhiza.

The leaves, divided into 2 parts, are unique. Eusporangiate ferns differ from leptosporangiate ferns in each sporangium developing from more than one cell initial, having a wall more than one cell thick, and having a large indefinite number of spore mother cells within it, and in the gametophytes being subterranean, mycorrhizal and non-green (although occasionally chloroplasts may develop in branches that reach the soil surface). They differ from the leptosporangiate ferns other than *Azolla* in their young leaves not being spirally coiled.

## 4. OPHIOGLOSSACEAE - *Adder's-tongue family*

**1. OPHIOGLOSSUM** L. - *Adder's-tongues*
Sterile blade simple, entire; fertile blade a simple spike of sunken sporangia.

1 Sterile blade rarely >2cm, linear to narrowly elliptic, the vein-islets without free vein endings; spores ripe Jan-Mar **3. O. lusitanicum**
1 Sterile blade rarely <2cm, oblong-elliptic to broadly so, the vein-islets with minute free vein-endings within them; spores ripe Apr-Aug 2
  2 Sterile blade mostly 3-3.5cm; sporangia 6-14 either side of spike **2. O. azoricum**
  2 Sterile blade mostly 4-15cm; sporangia 10-40 either side of spike **1. O. vulgatum**

**1. O. vulgatum** L. - *Adder's-tongue*. Leaves to 30(45)cm; sterile blade (3)4-15(30)cm, rounded to cuneate at base; fertile blade 1.5-5(7)cm; spores 26-41µm across; 2n=500-520, c.540 (highest chromosome number counted of any British plant). Native; grassland, dune-slacks, ditches, open woods, mostly in lowlands; frequent throughout most of BI except Orkney and Shetland.

**2. O. azoricum** C. Presl (*O. vulgatum* ssp. *ambiguum* (Coss. & Germ.) E.F. Warb.) - *Small Adder's-tongue*. Leaves to 10cm; sterile blade (1.5)3-3.5cm, strongly narrowed to ± stalked at base; fertile blade 0.8-2cm; spores 38-47µm across; (2n=720). Native; barish or grassy places on sandy or peaty damp soils near sea; very scattered round coasts of W BI E to S Hants, Caithness and Shetland. Possibly derived from *O. vulgatum* x *O. lusitanicum*. **RR**

**3. O. lusitanicum** L. - *Least Adder's-tongue*. Leaves to 2cm; sterile blade 0.6-3cm; fertile blade 0.3-1.5cm, with 3-8 sporangia on either side; spores 23-32µm across; 2n=250-260. Native; very short turf by sea; local in Guernsey (first found 1853) and Scilly (first found 1950). **RRR**

**2. BOTRYCHIUM** Sw. - *Moonwort*
Sterile blade pinnate; fertile blade a panicle of axes with sessile but not sunken sporangia.

**Other spp.** – 3 other spp. have been claimed as (now extinct) natives in the past. **B. matricariifolium** (Retz.) A. Braun ex W.D.J. Koch, from N Europe, is the most plausible; a specimen possibly of this is said to have been collected in Ayrs in 1875. It differs from *B. lunaria* in its 2-pinnate sterile blade.

**1. B. lunaria** (L.) Sw. - *Moonwort.* Leaves to 30cm; sterile blade 2-12cm, 1-pinnate, with asymmetric fan-shaped pinnules; fertile blade 1-5cm; 2n=90. Native; dry grassland, mostly in uplands; throughout Br and Ir, especially N & W Br.

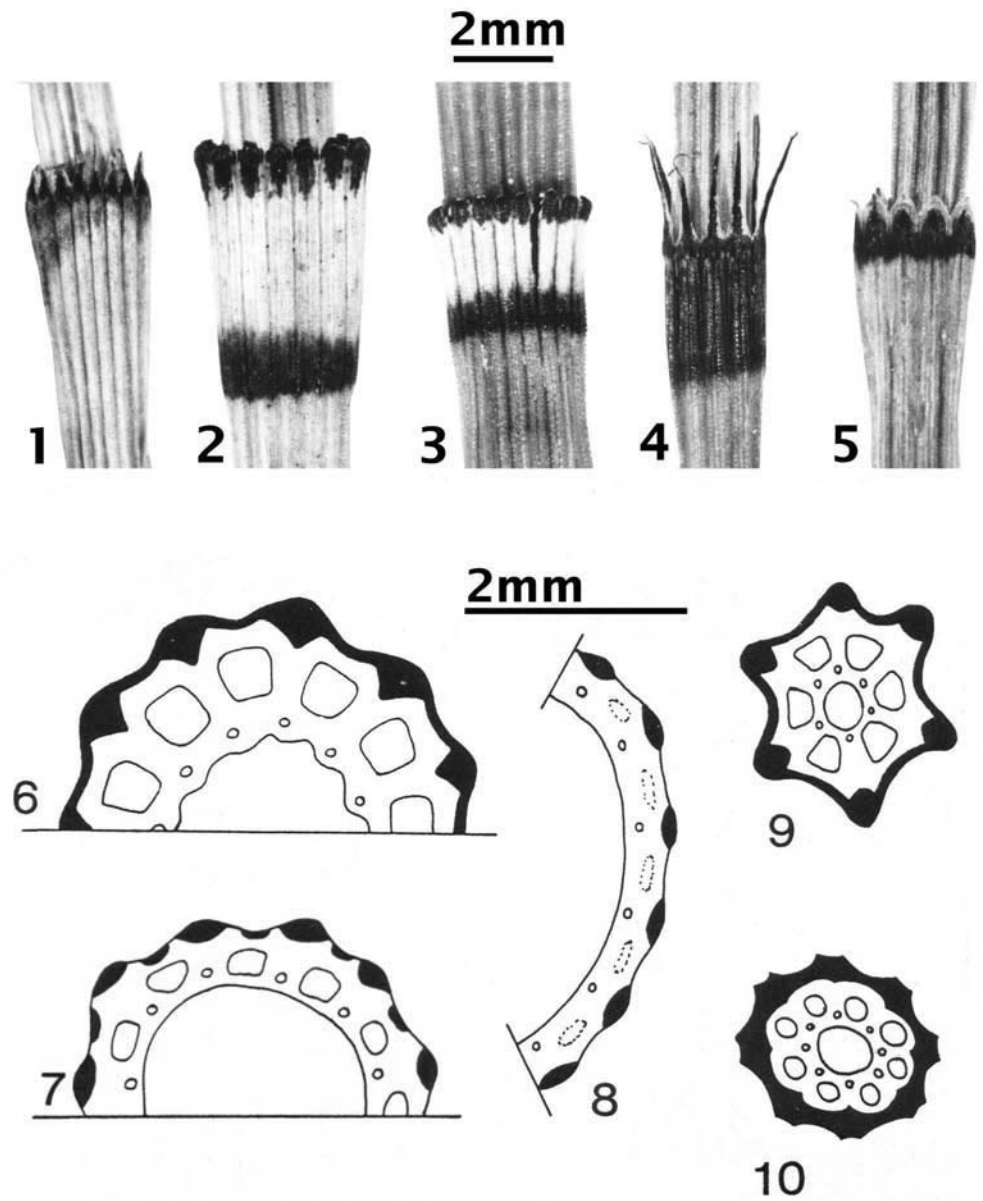


**FIG 10** - ***Equisetum***. 1-5, leaf-sheaths. 1, ***E. ramosissimum***. 2, ***E. x moorei***. 3, ***E. hyemale***. 4, ***E. x trachyodon***. 5, ***E. variegatum***. 6-10, leaf-internode sections. 6, ***E. arvense***. 7, ***E. x litorale***. 8, ***E. fluviatile***. 9, ***E. palustre***. 10, ***E. variegatum***. Drawings by C.A. Stace.