NATURAL HISTORY MUSEUM

# The biggest problems in European fern taxonomy?

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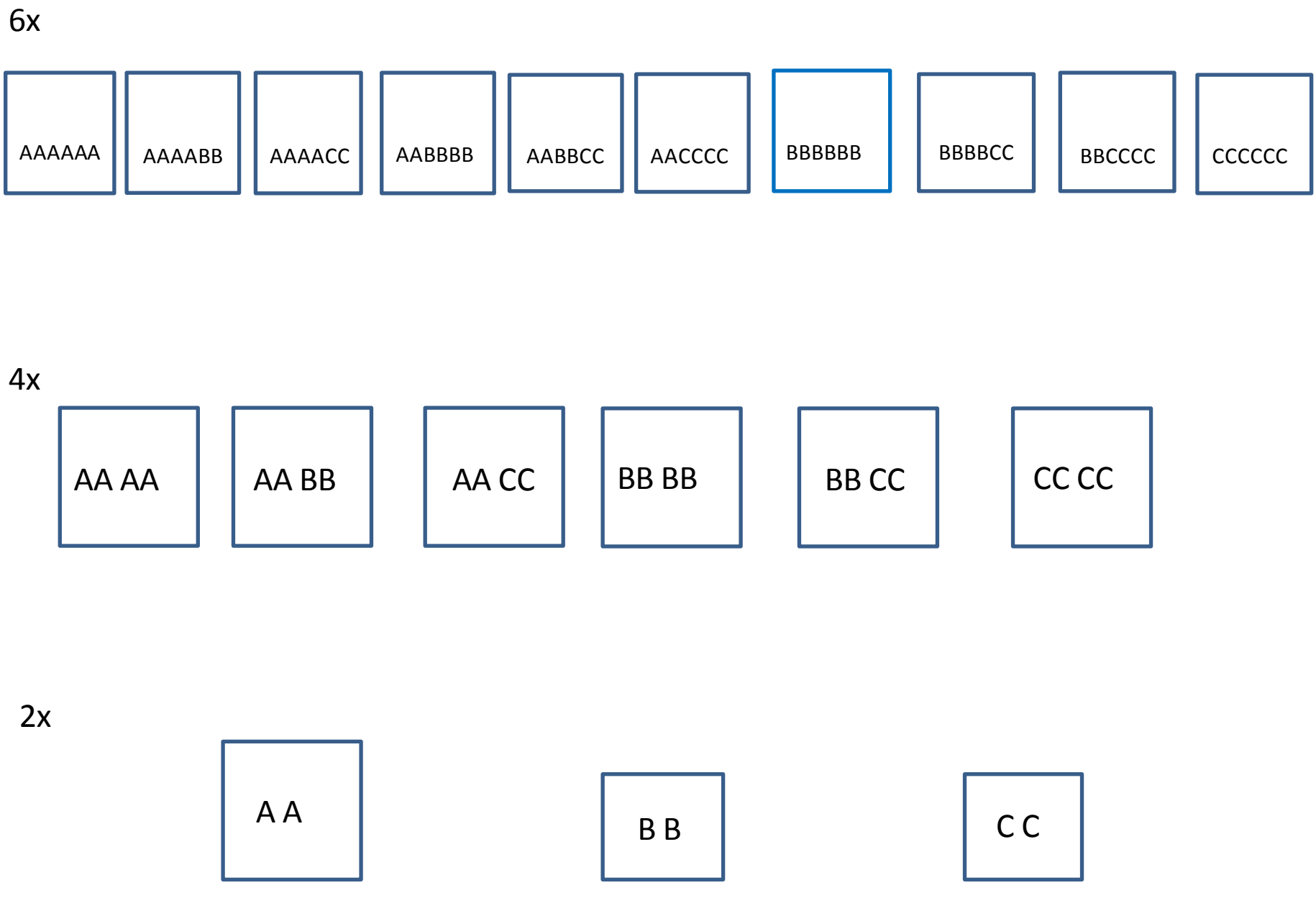
# *Cystopteris fragilis* agg.

- almost cosmopolitan
- taxonomy highly contentious
- polyploid complex from 2x-8x
- Diploids absent in Europe –
  - other than *C. reevesiana* Lellinger they are unknown
- At least 3 related progenitors probably involved
- ?Multiple (polytopic) origins for each polyploid cytotype
- Hybrids are +/-sterile

# Potential generation of multiple similar taxa



Manton, 1950

Fig. 119. Forms of '*Cystopteris fragilis*' with spiny spores and the low chromosome number ($n=84$), from living leaves grown in cultivation, natural size. *a*. From Swedish Lapland. *b*. From Rannoch Moor, Scotland. *c*. From Vancouver Island, Canada. *d*. From Preda, Switzerland.

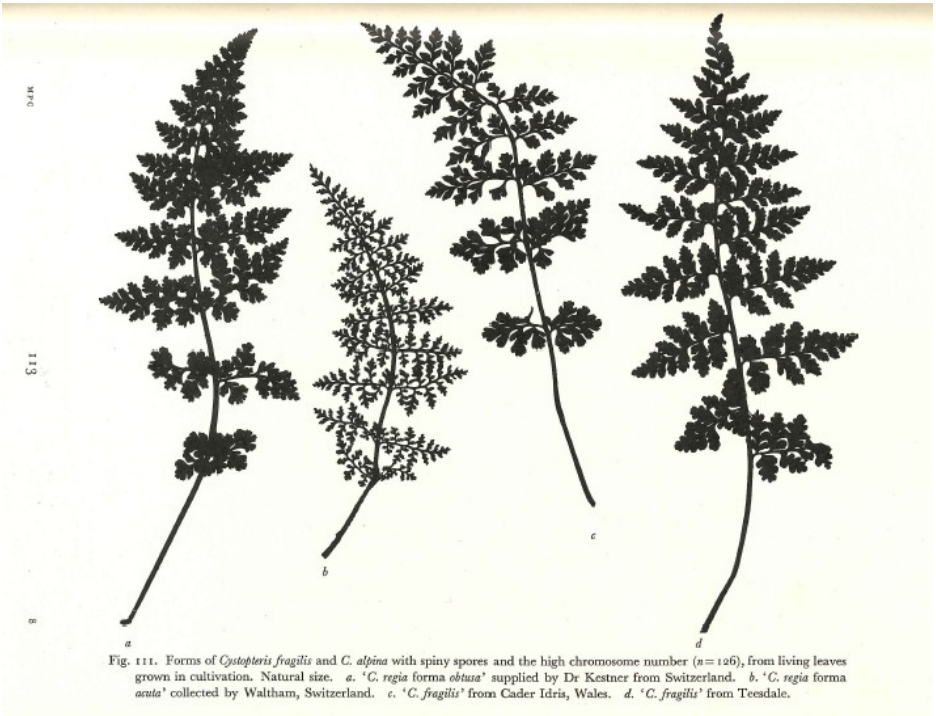


Fig. 111. Forms of *Cystopteris fragilis* and *C. alpina* with spiny spores and the high chromosome number ($n=126$), from living leaves grown in cultivation. Natural size. *a*. '*C. regia* forma *obtusa*' supplied by Dr Kestner from Switzerland. *b*. '*C. regia* forma *acuta*' collected by Waltham, Switzerland. *c*. '*C. fragilis*' from Cader Idris, Wales. *d*. '*C. fragilis*' from Teesdale.

*Cystopteris fragilis* s. lato

**Spore size as proxy for ploidy**

4X (27-)33-42(-48)µm

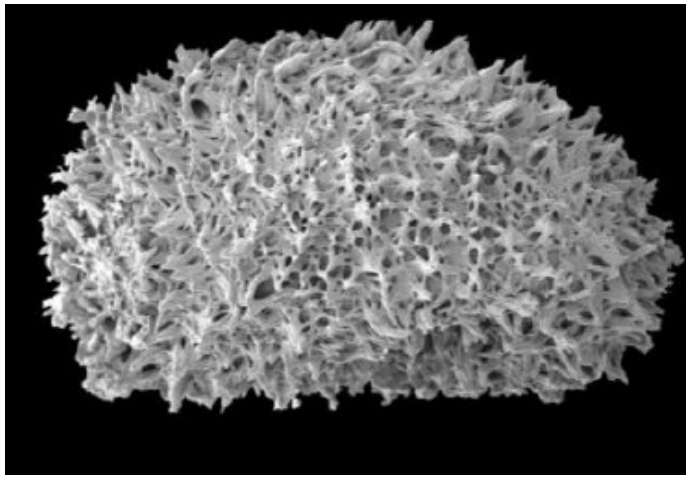
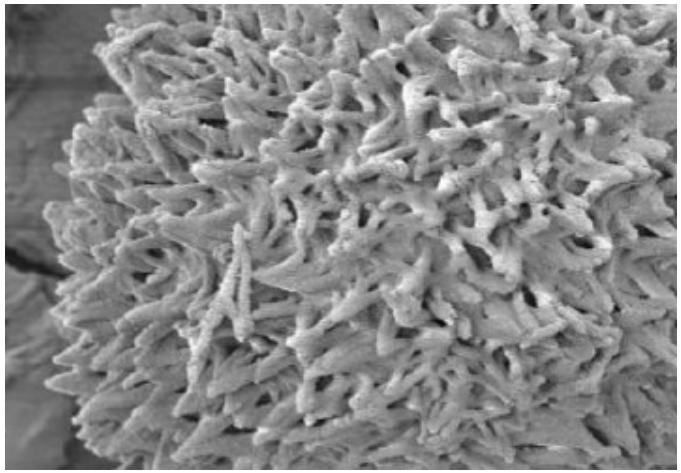
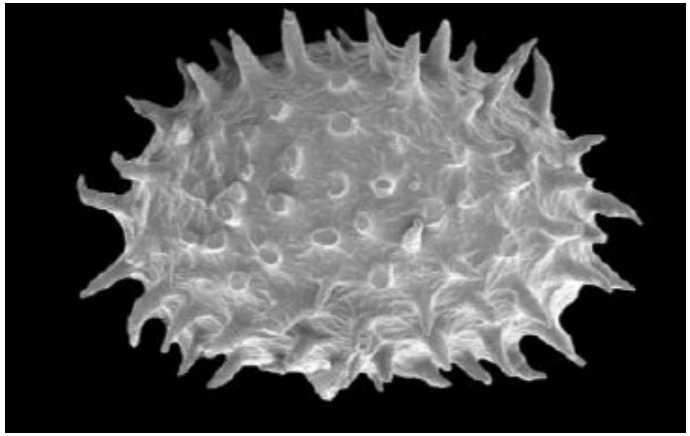
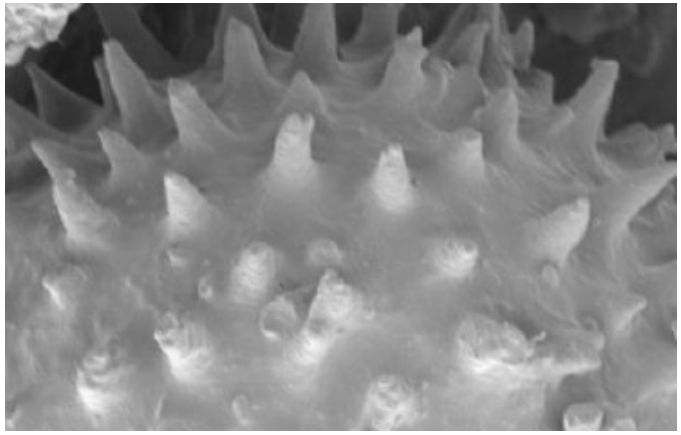
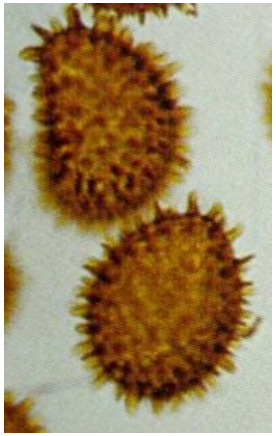
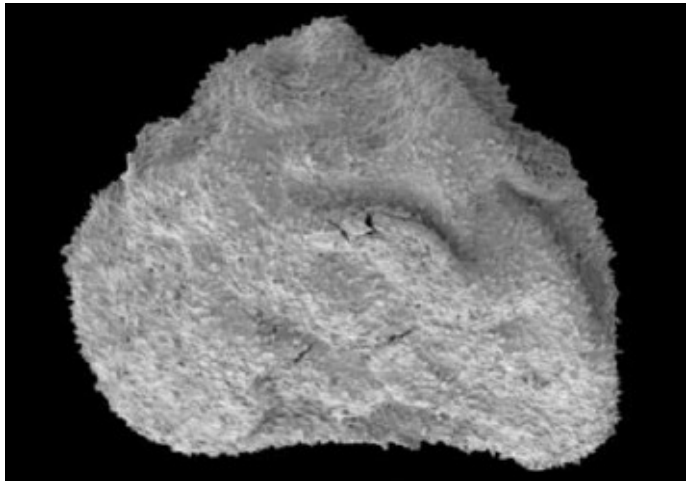
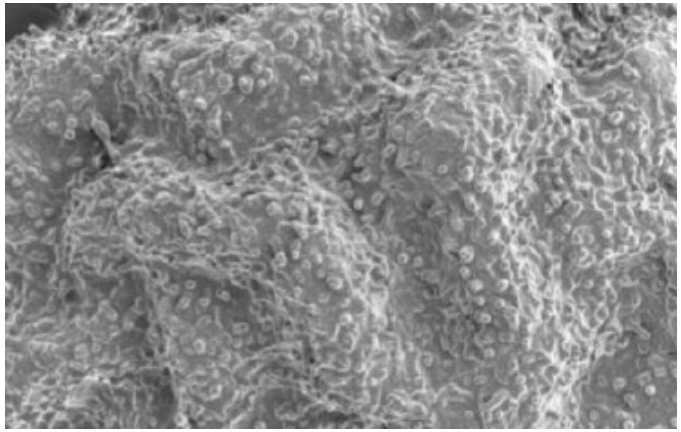
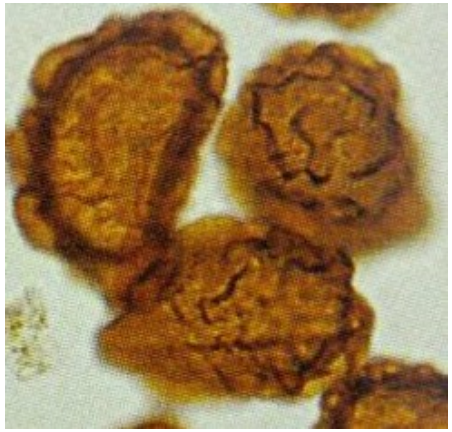
6X (28-)36-48(-54)µm

8X (33-)39-54(-60)µm
(Dostál in Hegi, 1984)

4X 32-42 µm

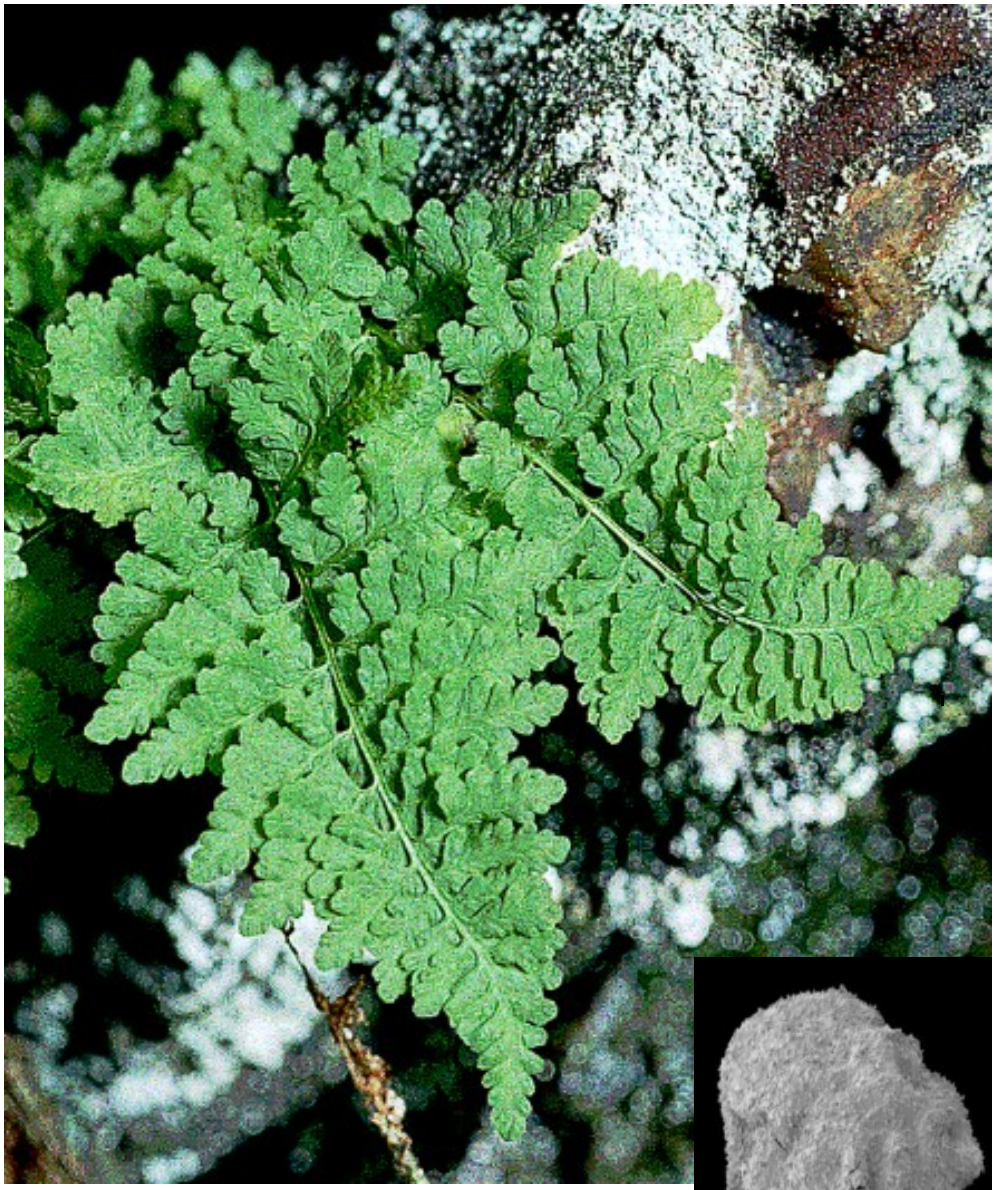
6X 38-48 µm

8X 43-53 µm
(Jermy & Harper, 1971 – quoting Blasdell, 1963)

*Cystopteris* spore types

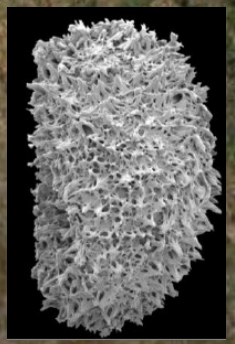
**Cystopteridaceae** - *Cystopteris fragilis* 4x-8x



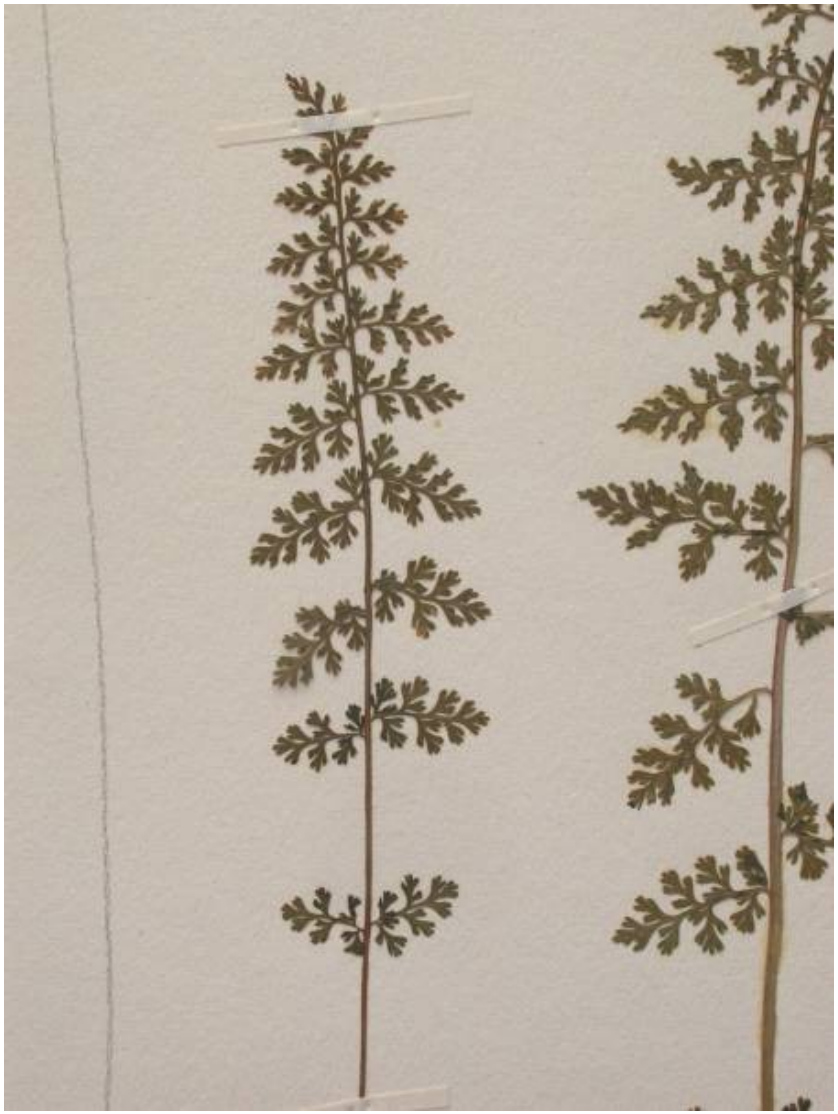


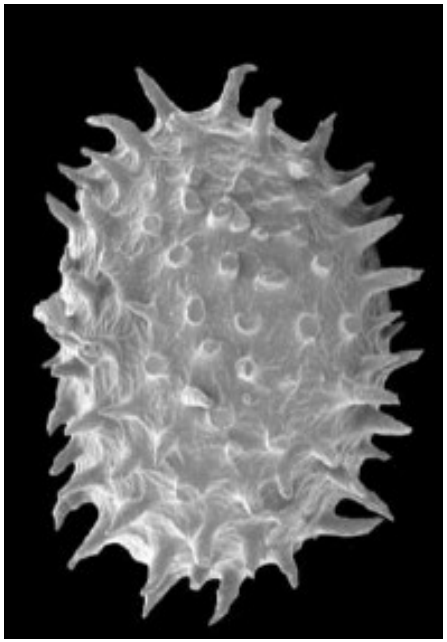
*C. dickieana* 4x; 6x

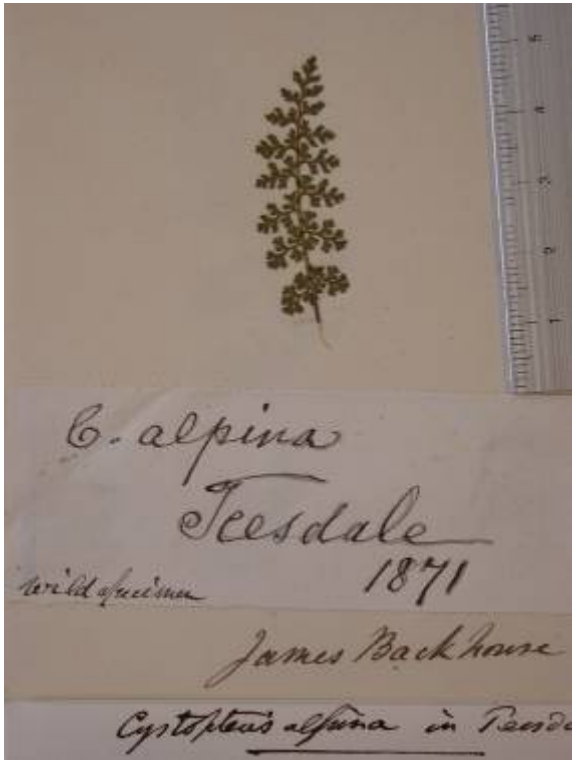
4x (30-)36-42(-48)µm
6x (30-)42-48(-54) µm

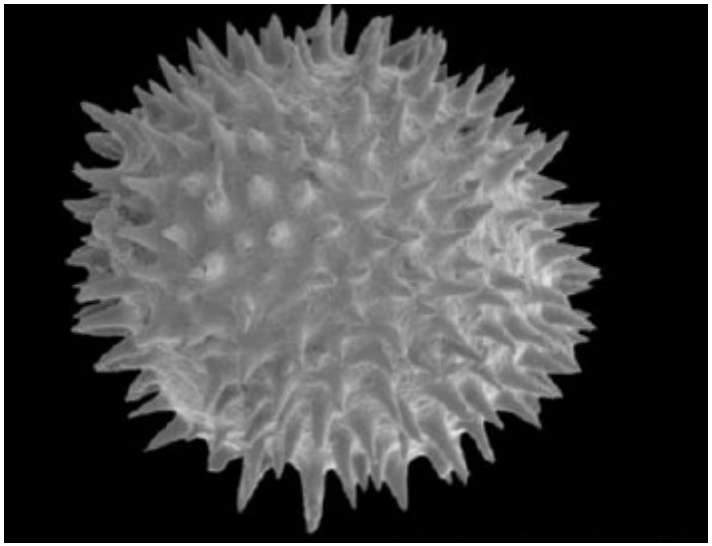
*C. diaphana* 6x (2x & 4x elsewhere)





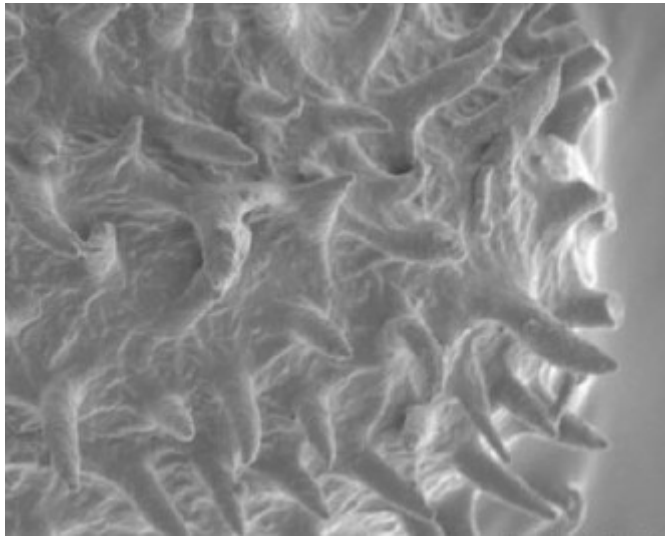



*Cystopteris alpina*



Scottish ?octoploid

Shows some similarities to *C. alpina* and *C. diaphana*.



mean spore length >53 µm

# Huperzia selago agg.

- "this species is, in my experience, the worst cytological object that I have ever encountered" Manton, 1950.

- A complex of cryptic taxa at a range of ploidy levels.
- Best recognised as species
- Distinctions masked by paucity of characters, plasticity, environmental responses and hybridisation.

# *Huperzia* in North America

- 9 spp. of which 4 spp. occur in the high arctic and might be expected in northern Europe/the UK

- ***H. appressa* (Desv.) Á. Löve** (syn. *H. appalachiana* Mickel & Beitel) (N.E N. America)
- ***H. arctica* (Gross. ex Tolm.) Sipliv.** (syn. *H. selago* subsp. *arctica* (Gross. ex Tolm.) Á. & D. Löve (High Arctic)
- ***H. continentalis* Testo, A. Haines & A.V. Gilman** (syn. *H. haleakalae* sensu F. N. A) (N.W. N. America)
- ***H. selago*(L.) Bernh. ex Schrank & Mart.**

# Key to Arctic *Huperzia*

H. selago

1. Gemmae in 1 (-2) pseudowhorls at end of annual growth, usually >4mm long *H. selago*

   Gemmae continuously produced throughout growth, usually <3.5mm long 2.

H. arctica

2. Plant usually <7cm, foliage strongly dimorphic, upper leaves <3mm, triangular, arched-ascending *H. arctica*

   Plant usually >7cm, foliage somewhat dimorphic, upper leaves >3mm, narrowly triangular, straight-ascending 3.

H. appressa

3. Gemmae 3.0-3.4 × 2.0-2.3 mm, leaf dimorphy abrupt, plant usually matt, green *H. appressa*

   Gemmae 2.0-3.2 × 2.1-3.1 mm, leaf dimorphy gradual, plant glossy, yellow *H. continentalis*

* Hybrids are frequent, intermediate and +/- sterile

# *Huperzia arctica*


- Typical material seen from VC.112 (Unst & Fetlar)
- Probable material from Uig, Lewis (Valtos Glen, M.S. Campbell, 390721E BM!)

- potentially elsewhere - but I think most narrow, yellow Scots plants aren't it.

- small stature
- gemmae small, cupped
- continuously gemmiferous in upper portion of shoot
- upper leaves short, triangular -much shorter (c.50%) than lower leaves.
- whole plant lustrous, yellow

# Hybrids

- from chromosomal behaviour Manton believed plants she investigated to be hybrid in origin.
- Hybridisation is frequent!
- Plants are generally narrow, yellowish, with more than 1 whorl of gemmifers per growth period
- Check for malformed, misshapen and empty spores, or spores of widely differing sizes and shapes

- ……but what are they hybrids between?

# Acknowledgements


- Grateful thanks to David Tennant who has been patiently working with me on resolving problems in *Cystopteris* he has been aware of for decades!
- To Wes Testo for sharing as yet unpublished material on N.American *Huperzia*