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Hybridization studies involving *Asplenium pseudofontanum* Kossinsky (Aspleniaceae, Pteridophyta)

MARY GIBBY

RÉSUMÉ

GIBBY, M. (1982). Etudes d'hybridisation avec *Asplenium pseudofontanum* Kossinsky (Aspléniacées, Ptéridophytes). *Candollea* 37: 235-242. En anglais, résumé français.

On a produit des hybrides entre *Asplenium pseudofontanum* Kossinsky diploïde ($2n = 72$) et deux espèces tétraploïdes, *A. foreziense* Héribaud ($2n = 144$) et *A. majoricum* Litard. ($2n = 144$). Les deux hybrides triploïdes présentent 36 bivalents et 36 univalents à la méiose. Ces résultats sont identiques à ceux obtenus en produisant des hybrides triploïdes à partir des deux tétraploïdes et de l'espèce diploïde *A. fontanum* (L.) Bernh. ($2n = 72$). *A. pseudofontanum* et *A. fontanum* semblent exprimer le même génome. Cette constatation ajoutée à diverses ressemblances morphologiques démontre que les deux diploïdes sont conspécifiques.

ABSTRACT

GIBBY, M. (1982). Hybridization studies involving *Asplenium pseudofontanum* Kossinsky (Aspleniaceae, Pteridophyta). *Candollea* 37: 235-242. In English, French abstract.

Hybrids have been synthesized between the diploid *Asplenium pseudofontanum* Kossinsky ($2n = 72$) and two tetraploid species, *A. foreziense* Héribaud ($2n = 144$) and *A. majoricum* Litard. ($2n = 144$). Both triploid hybrids show 36 bivalents and 36 univalents at meiosis. These results are identical with those from synthesized triploid hybrids involving the two tetraploids and the diploid species *A. fontanum* (L.) Bernh. ($2n = 72$); *A. pseudofontanum* and *A. fontanum* appear to represent the same genome. This, together with their morphological similarities, provides evidence that the two diploids are conspecific.

Introduction

Asplenium fontanum (L.) Bernh. has been shown to be one of the diploid parents of two allotetraploid species, namely *A. majoricum* Litard. ($2n = 144$) and *A. foreziense* Héribaud* ($2n = 144$) (SLEEP, 1966, 1967, 1982). Triploid backcross hybrids of both tetraploids with *A. fontanum* show 36 bivalents and 36 univalents at meiosis; in an attempt to compare the genomes of *A. pseudofontanum* with *A. fontanum*, hybrids were synthesized between *A. pseudofontanum* and each of the two tetraploids, *A. majoricum* and *A. foreziense*. The results are presented below.

Materials and methods

The ferns used in the hybridization programme were from the following sources.

A. pseudofontanum

TR-3902. Progeny of W. Frey 604, Afghanistan, Prov. Kapisa, Spe Valley (Alasoy) 2200 m, moist silicate rocks. Coll. W. Frey, W. Pobst & A. Shaw 7.9.1974.

A. foreziense

TR-4023. Switzerland, Ct. Ticino, along path from Brissago to Piodina, ca. 300 m. Coll. H. L. & T. Reichstein 20.8.1976. TR-859 from same place, coll. 1.6.1963.

*Editorial note.

- Asplenium foreziense** Héribaud in Magnier: Fl. Selecta Exsicc. No. 743. [In schedis distr. 1884 ex Magnier, C.: Scrinia Florae Selectae 3: 65. 1884]; Le Grand in Giraudias: Soc. Dauph. Ech. Pl. 12: 501. 1885.
- = *Asplenium forisiense* Le Grand: Stat. Bot. Forez in Ann. Soc. Sci. Loire 17: 378. 1873 [nom. inval.].
- = *Asplenium foresiense* Le Grand in Magnier: Fl. Selecta Exsicc. No. 743 bis. [In schedis distr. 1892 ex Magnier, C.: Scrinia Florae Selectae 11: 237. 1892]; Le Grand ex Sudre in Rev. Bot. Bull. Mens. 12: 29. 1894.
- = *Asplenium foresiacum* (Le Grand) Christ in Beitr. Kryptogamenfl. Schweiz 1/2: 84. 1900; ≡ *Asplenium halleri* var. *foresiacum* Le Grand in Bull. Soc. Bot. France 16: 61. 1869; ≡ *Asplenium fontanum* subsp. *foresiacum* (Le Grand) Christ: Foug. Alpes Marit.: 14. 1900; ≡ *Asplenium lanceolatum* subsp. *foresiacum* (Le Grand) Mattiolo in Fiori & Béguinot: Sched. Fl. Ital. Exsicc. in Nuovo Giorn. Bot. Ital. ser. 2, 17: 565. 1910.

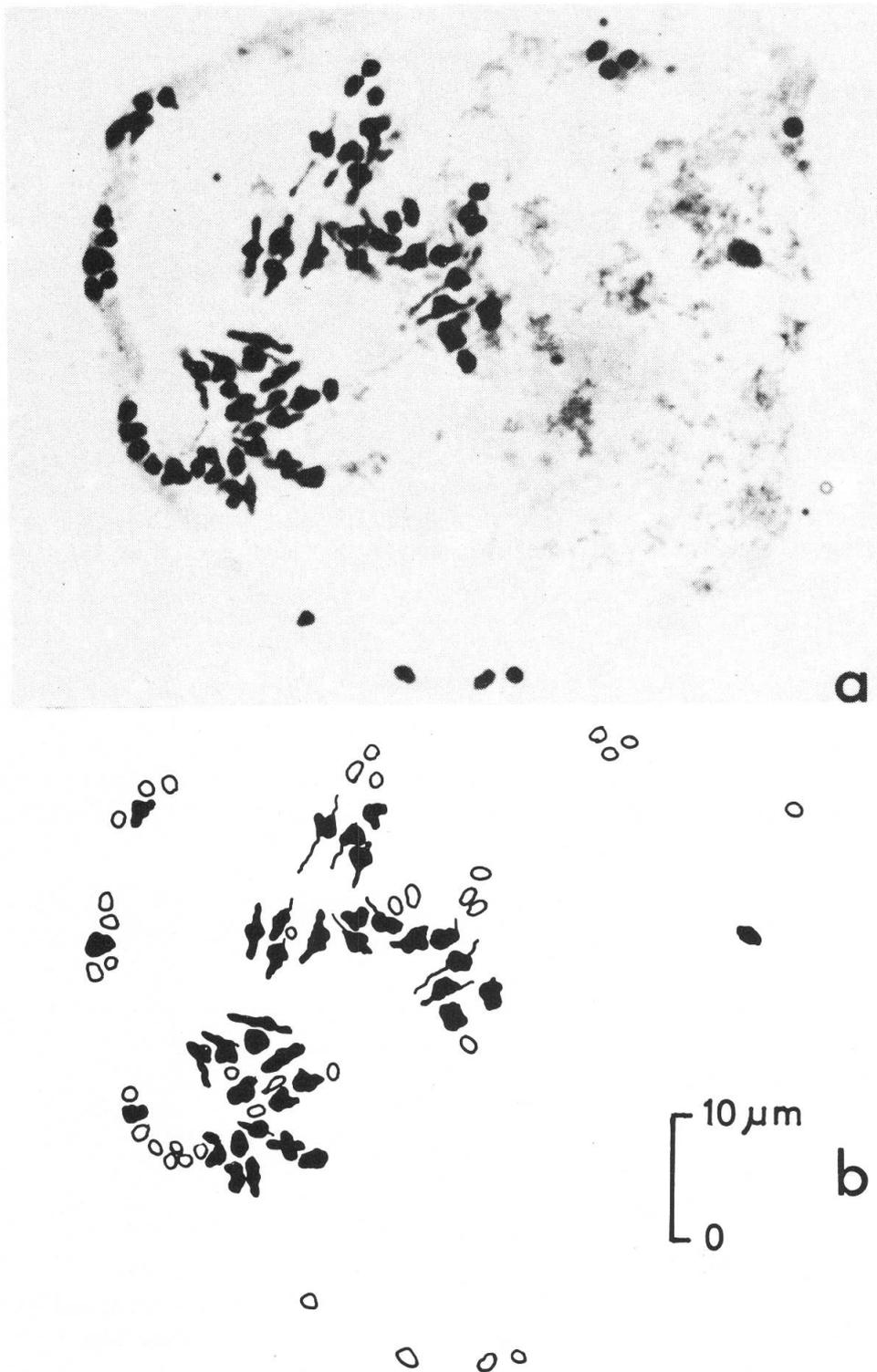


Fig. 1. — **a**, *Asplenium pseudofontanum* × *foreziense* H 1425 iv. Spore mother cell preparation showing 36 bivalents and 36 univalents at meiosis ($\times 1500$); **b**, explanatory diagram of Fig. 1a. Bivalents in black, univalents outlined.

A. majoricum

TR-4456. Mallorca, Barranc, S.E. of Biniaraix, ca. 120 m, N. exp. in limestone walls and rocks, olive groves (locus classicus). Coll. J. Orell, A. & A. Castanyer, J. & M. Schneller & T. Reichstein.

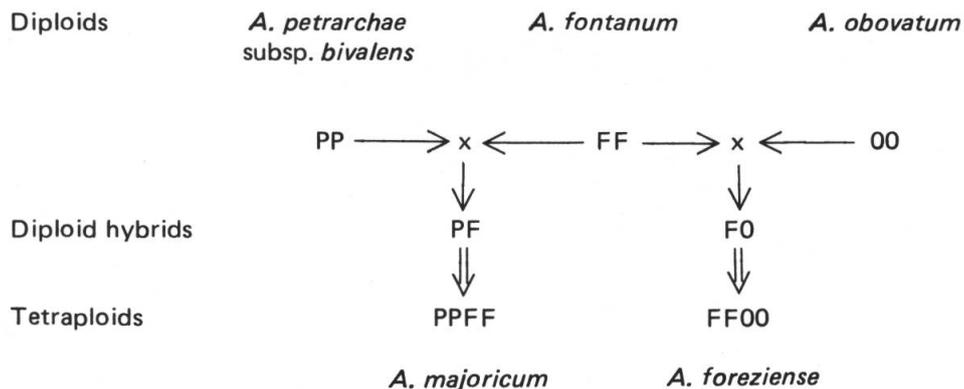
The fern hybridization technique was that described by LOVIS (1968). Spore mother cells were squashed in acetocarmine, following the technique of MANTON (1950).

Results

Details of the hybridization attempts are given in Table 1. One hybrid of *A. pseudofontanum* × *foreziense* was synthesized and 18 hybrids of *A. pseudofontanum* × *majoricum*. Cytological analyses of meiosis in several of these hybrids are given in Table 2, and two cells are illustrated in Figs. 1 and 2. Silhouettes of the species and hybrids are shown in Fig. 3. The hybrids are clearly intermediate in their morphology.

Discussion

If we represent the genome formula of *A. fontanum* as FF, the parentage of the tetraploids *A. majoricum* and *A. foreziense* may be summarized as follows:



There is strong evidence to suggest that *A. majoricum* has evolved from a diploid hybrid (PF) between the diploid species *A. petrarchae* subsp. *bivalens* (LOVIS & REICHSTEIN, 1969) and *A. fontanum* (SLEEP, op. cit.), followed by chromosome duplication. *A. majoricum* has been resynthesized from these two diploids by Lovis (unpublished); it may be represented by the genome formula PPF. Similarly, experimental evidence is available which shows that

| | Prothalli | Sporophytes | Selfs | Hybrids |
|--|-----------|-------------|-------|---------|
| <i>A. pseudofontanum</i> × <i>foreziense</i> | | | | |
| H 1315 | 5 | — | — | — |
| H 1316 | 5 | — | — | — |
| H 1424 | 10 | — | — | — |
| H 1425 | 12 | 8 | 7 | 1 |
| <i>A. foreziense</i> × <i>pseudofontanum</i> | | | | |
| H 1326 | 5 | — | — | — |
| H 1327 | 5 | 1 | 1 | — |
| <i>A. pseudofontanum</i> × <i>majoricum</i> | | | | |
| H 1426 | 16 | 11 | 5 | 6 |
| H 1427 | 13 | 7 | 5 | 2 |
| H 1428 | 17 | 13 | 3 | 10 |

Table 1. — Hybridization attempts (female parent is given first)

| | Bivalents | Univalents |
|--|-----------|------------|
| <i>A. pseudofontanum</i> × <i>foreziense</i> | | |
| H 1425iv | 36 | 36 |
| | 34 | 40 |
| <i>A. pseudofontanum</i> × <i>majoricum</i> | | |
| H 1426ix | 34 | 40 |
| | 33 | 42 |
| | 29 | 50 |
| H 1428vi | 35 | 38 |
| H 1428viii | 36 | 36 |
| H 1428ix | 35 | 38 |
| H 1428xi | 33 | 42 |
| | 34 | 40 |
| H 1428xiii | 33 | 42 |
| | 35 | 38 |
| | 32 | 44 |
| | 35 | 38 |
| | 35 | 38 |

Table 2. — Cytological analyses of hybrids

A. foreziense has evolved from *A. fontanum* and *A. obovatum* (represented by 00) (SLEEP, 1966).

The triploid backcross hybrids *A. fontanum* × *majoricum* and *A. fontanum* × *foreziense* both showed 36 bivalents and 36 univalents (SLEEP, op. cit.); this pairing represents allosyndetic pairing and is summarized diagrammatically below:

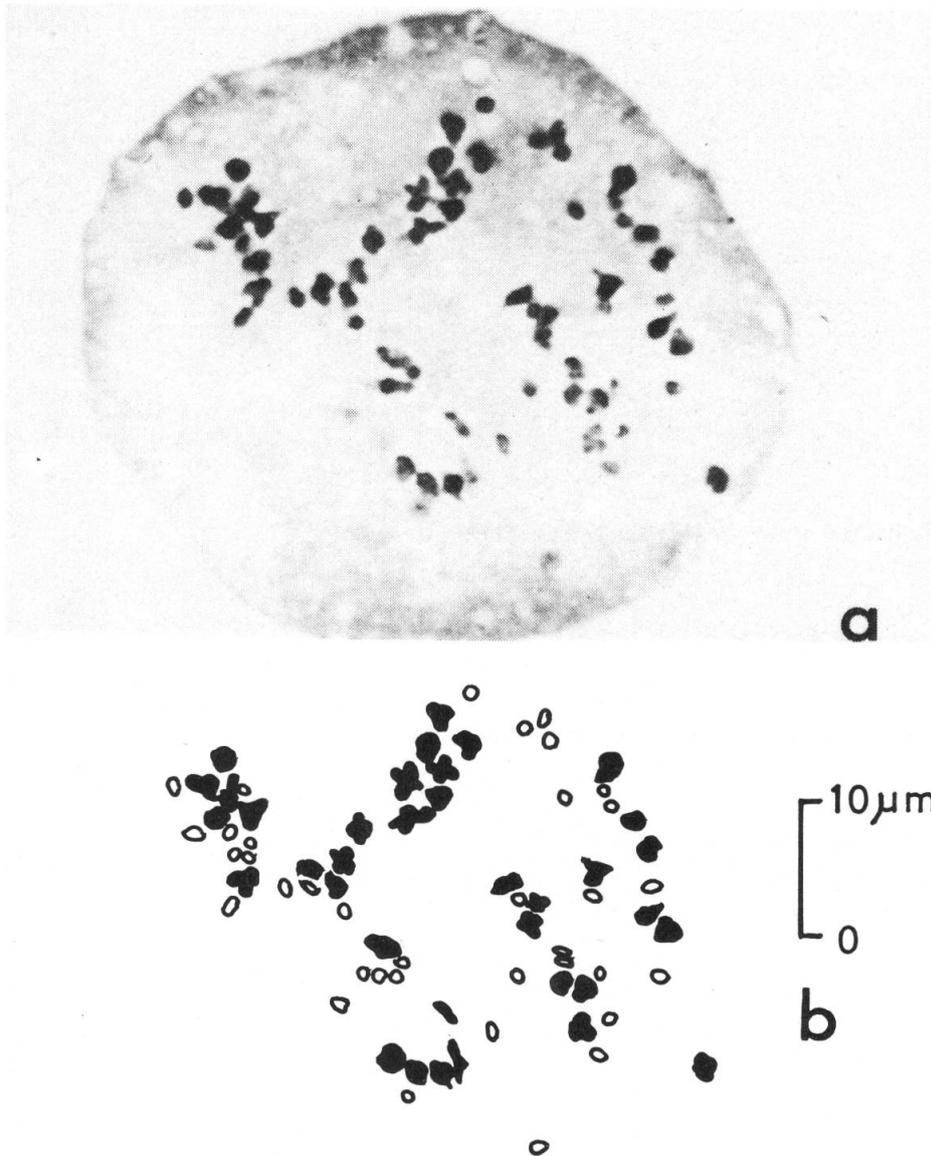
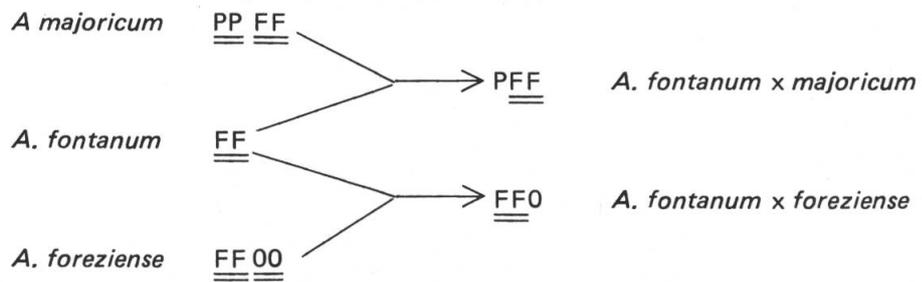


Fig. 2. — **a**, *Asplenium pseudofontanum* × *majoricum* H 1428 viii. Spore mother cell preparation showing 36 bivalents and 36 univalents at meiosis (× 1500); **b**, explanatory diagram of Fig. 2a. Bivalents in black, univalents outlined.



The double underlining represents chromosome pairing

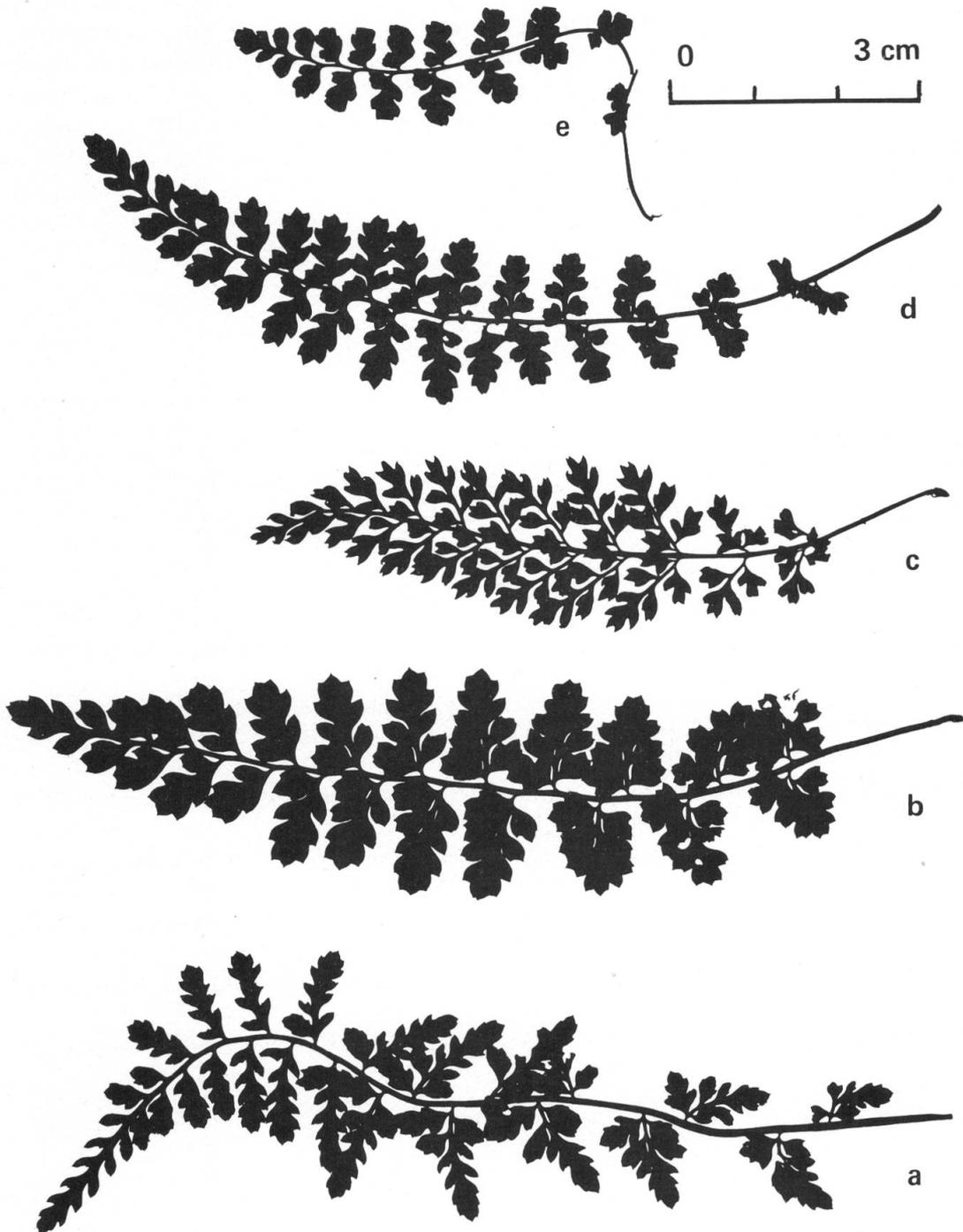


Fig. 3. — Silhouettes, all life size. **a**, *Asplenium foreziense* TR-859; **b**, *Asplenium pseudofontanum* × *foreziense* H 1425 iv; **c**, *Asplenium pseudofontanum* TR-3902; **d**, *Asplenium pseudofontanum* × *majoricum* H. 1428 xiii; **e**, *Asplenium majoricum* TR-4456.

The hybrids *A. pseudofontanum* × *majoricum* and *A. pseudofontanum* × *foreziense* both show up to a maximum of 36 bivalents with 36 univalents at meiosis. The consistent occurrence of 33-36 bivalents is completely in agreement with the results obtained by Sleep from the parallel hybrids *A. fontanum* × *majoricum* and *A. fontanum* × *foreziense*. These results suggest strongly that *A. pseudofontanum* also has the genome formula FF, and, like *A. fontanum*, represents one of the diploid parents of *A. majoricum* and *A. foreziense*. This supports the view of REICHSTEIN & SCHNELLER (1982) that *A. pseudofontanum* should be regarded as a subspecies of *A. fontanum*.

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