Asplenium adulterinum Milde subsp. presolanense subsp. nova (Aspleniaceae, Pteridophyta)

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Asplenium adulterinum Milde subsp. *presolanense* subsp. nova (Aspleniaceae, Pteridophyta)

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Abstract

F. Mokry, Helga Rasbach, and T. Reichstein, 1986. *Asplenium adulterinum* Milde subsp. *presolanense* subsp. nova (Aspleniaceae, Pteridophyta). Bot. Helv. 96: 7–18.

Asplenium adulterinum Milde is a small fern growing nearly exclusively on magnesite, serpentinite, and other ultrabasic rocks. It is known only from northern, central, and eastern Europe. We describe a new, closely related taxon as subsp. *presolanense* from the Presolana (Alps of Bergamo) in Italy, later also found in the Val Poschiavo (Kt. Graubünden, Switzerland). It differs from subsp. *adulterinum* by more prostrate habit, less crenate, often touching or overlapping pinnae, usually wider terminal pinna, and mainly by growing on shaded limestone rocks or silicate schists. In Europe it has so far only been found on the Presolana and in the Val Poschiavo, but it had already previously been obtained under experimental conditions by spontaneous chromosome doubling in the natural hybrid *A.* × *adulteriniforme* Lovis, Melzer & Reichstein.

1. Introduction

Asplenium adulterinum Milde (1865) is a small allotetraploid fern, so far known as endemic to northern, central, and eastern Europe (but see "Note 2" below) and virtually confined to magnesite, serpentinite, and other ultrabasic rocks and scree. It is reported from Scandinavia, Italy, Switzerland, western and eastern Germany, Austria, Czechoslovakia, Yugoslavia, Poland, Rumania, and Greece (Jalas & Suominen 1972, map 82). It once originated, and may still form occasionally today, in suitable places, by spontaneous chromosome doubling in the diploid hybrid *A.* × *protoadulterinum* Lovis & Reichstein (1968 a, b) = *A. trichomanes* L. subsp. *trichomanes* (sensu Lovis 1964) × *A. viride* Hudson. This hybrid is very rare but very readily doubles its chromosomes spontaneously. This process could be observed under experimental conditions (Lovis & Reichstein 1968 a, b) and the hybrid itself could be obtained by artificial crossing (Lovis 1968). In Austria, Melzer found another, closely related hybrid, *A.* × *adulteriniforme* Lovis, Melzer & Reichstein (1965) = *A. trichomanes* subsp. *inexpectans* Lovis (1965) × *A. viride*. This hybrid, found so far only on shady limestone

rocks in Austria, together with both of its parents, is also relatively rare, but more common than *A.* ×*protoadulterinum.* Like the latter, it doubles its chromosomes easily under experimental conditions. The so obtained tetraploid plants produced good spores and were rather close in morphology to *A. adulterinum* but differed slightly in having usually less crenate pinna margins, more crowded, sometimes even imbricate pinnae, a slightly wider terminal pinna, and less upright habit with more drooping or prostrate fronds. In spite of prolonged systematic search around the diploid hybrids, such tetraploid plants have never been found in Austria. In summer 1979, however, a small colony was detected by F. Mokry in northern Italy on the northern side of the Presolana (Prov. Bergamo). It is described here as a new subspecies of *A. adulterinum.*

Note 1 on the nomenclature: According to the new Code (E.G. Voss et al. 1983) the valid names for the hybrids mentioned here as *A.* ×*proto-adulterinum* and *A.* ×*adulteriniforme* must be: *A.* ×*bavaricum* D. E. Meyer (1958) nothosubsp. *protoadulterinum* (Lovis et Reichstein) Mokry, Rasbach et Reichstein (1986) and *A.* ×*bavaricum* D. E. Meyer nothosubsp. *adulteriniforme* (Lovis, Melzer et Reichstein) Mokry, Rasbach et Reichstein (1986). In the text of this article we use the original old names.

2. *Asplenium adulterinum* Milde subsp. *presolanense* Mokry, Rasbach & Reichstein, subsp. nova

Typus: Ras-369, 9. 9. 1983, leg. H.&K. Rasbach. Holotype G. T. Reichstein 5082 progeny, raised in Basel from spores of F. Mokry s.n., 31. 7. 1979, will be deposited as paratypes in G, BM, FI, OAC, RO, and Z.

Locus: Italy, Prov. Bergamo, northern slope of the Presolana, tributary valley of the Valle di Scalve, shady limestone rocks above Còlere, at ca. 1200 m alt.

Derivatio: Named after the Presolana, a mountain famous for several endemic plants.

Diagnosis: Recedit a subspecie *adulterinum* habitu potius prostrato nec erecto; marginibusque pinnarum minus crenulatis vel integris; pinnisque aggregatioribus, interdum imbricatis; et habitatione: rupes calcareae umbrosae (nec serpentinaceae vel rupes aliae ultrabasicae).

Description. Subsp. *presolanense* is tetraploid with 72^{II} at meiosis (fig. 7) like subsp. *adulterinum.* It differs from the latter in a similar way as does its progenitor *A.* ×*adul-*

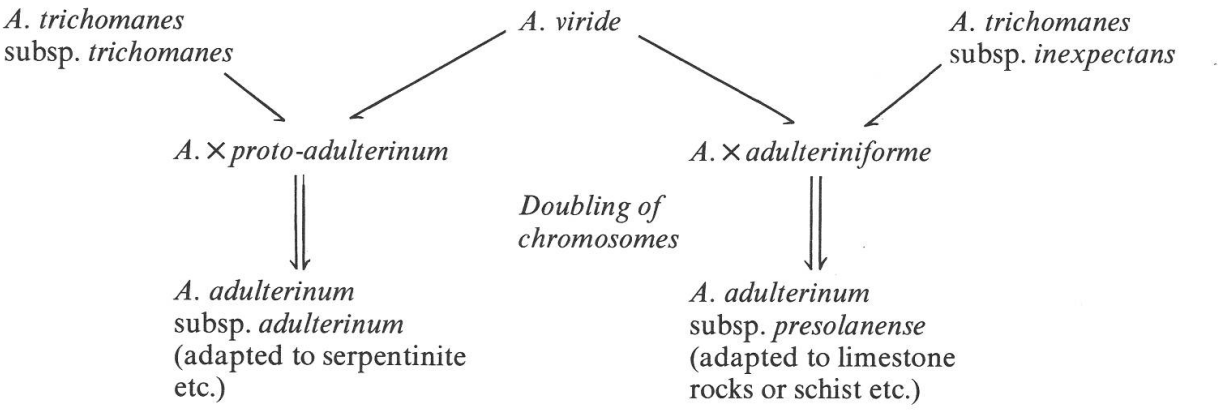


Fig. 1. Presumed formation of the two subspecies of *A. adulterinum*

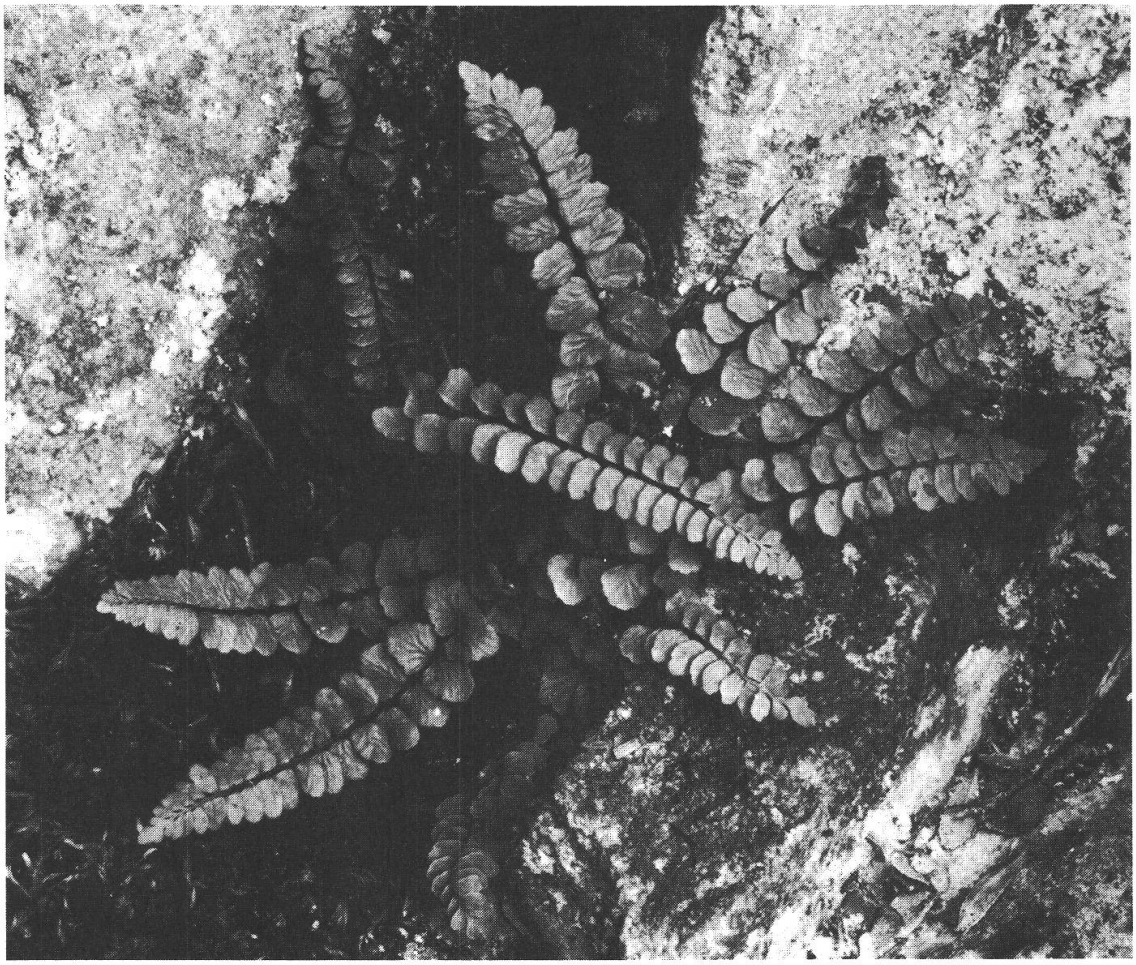


Fig. 2. *Asplenium adulterinum* subsp. *presolanense* in situ, on shady limestone rocks at ca. 1210 m alt. Photo K. Rasbach 9. IX. 1983

Tab. 1. Characters for differentiating the two subspecies of *A. adulterinum*.

	Subsp. *presolanense*	Subsp. *adulterinum*
Arrangement of pinnae	Usually touching or imbricate	Usually not touching nor imbricate
Pinna margin	Entire or slightly (less than 0.2 mm deep) crenate	Usually distinctly (more than 0.2 mm deep) crenate
Terminal pinna	Ca. 1–5 mm wide	Ca. 0.5–2 mm wide
Habit	Fronds drooping or prostrate	Fronds erect
Ecology	Shady limestone rocks or mica schists	Shady or sunny ultrabasic rocks (mainly serpentinite or magnesite)

teriniforme from *A.* × *proto-adulterinum.* As can be seen from table 1 and fig. 4, the morphological differences are small. The ecological difference is, however, pronounced. There is therefore hardly a chance that the two subspecies will meet in nature, and we strongly suspect that this ecological barrier is the main reason for their survival as distinct taxa. Theoretically we may expect that wherever they would meet, they would produce fertile hybrids and intergrade completely. This has not yet been checked experimentally. But Lovis (unpubl., see Reichstein 1981: 106 under 29 b) made the experimental hybrid *A. trichomanes* subsp. *inexpectans* × subsp. *trichomanes* (Tr'Tr) and found that it shows complete pairing at meiosis and produces fertile spores. The two diploid subspecies of *A. trichomanes,* i.e. subsp. *inexpectans* (Tr'Tr'), found only on shady limestone rocks, and subsp. *trichomanes* (TrTr), found only on siliceous rocks (gneiss, granite, serpentinite, etc.), are also only ecologically separated. Their slightly different genomes, (TrTr) and (Tr'Tr'), respectively, are fully homologous and cannot be distinguished by pairing behaviour in cytological examination, although they express themselves in small differences of morphology and different

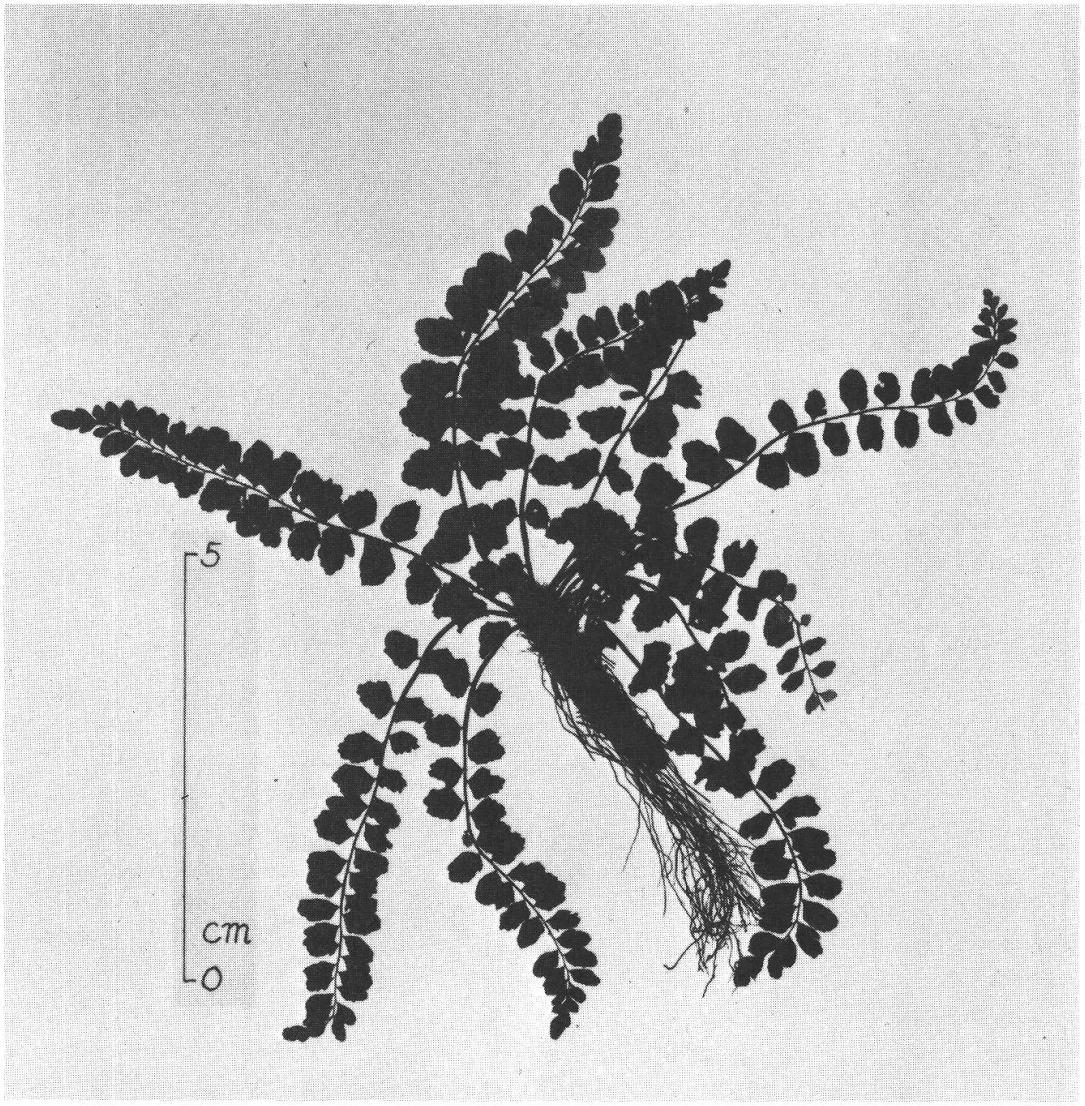


Fig. 3. *Asplenium adulterinum* subsp. *presolanense,* silhouette of type specimen, Ras-369, G.

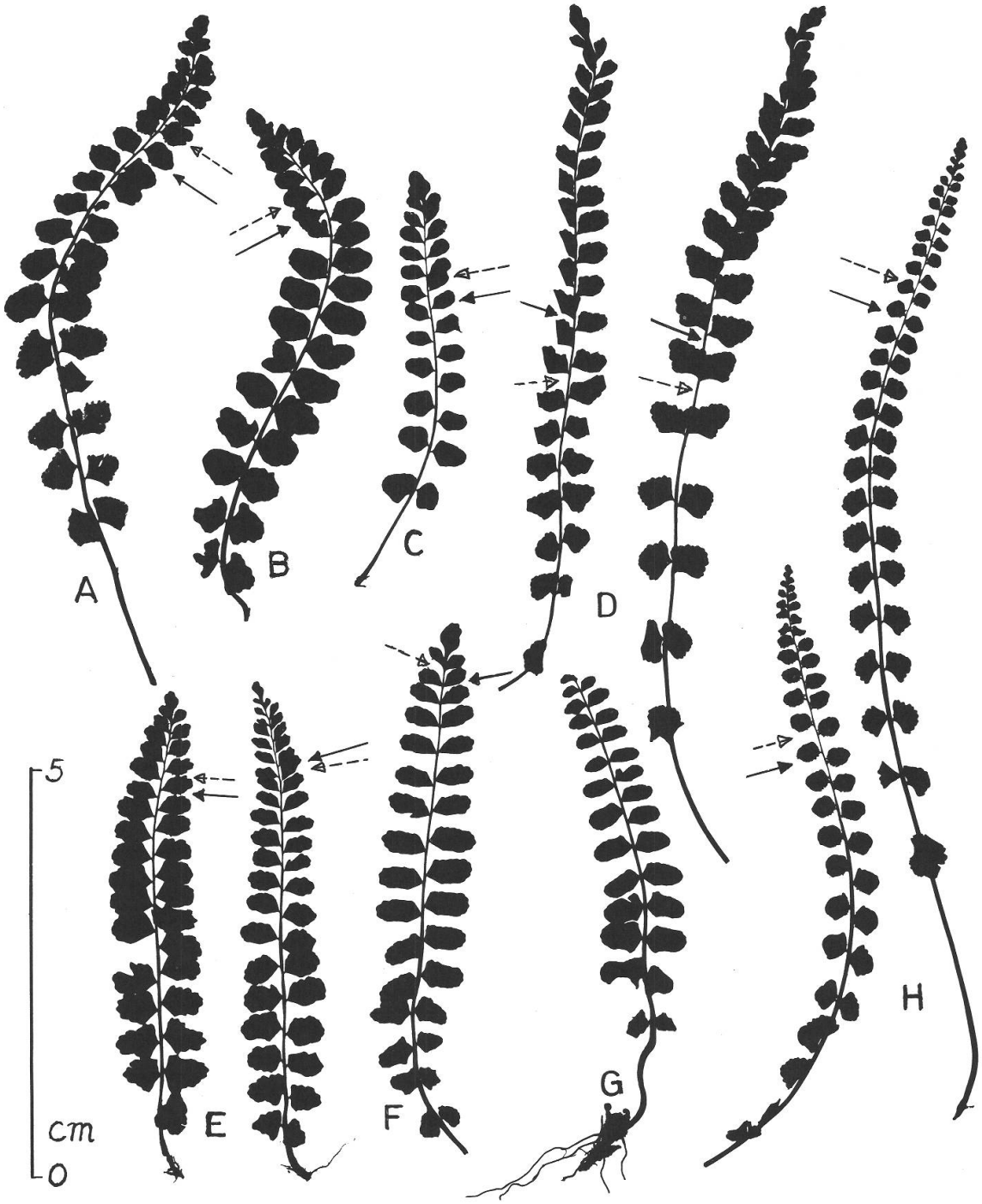


Fig. 4. Silhouettes of pressed fronds of the two subspecies of *Asplenium adulterinum* and the hybrid Ras-363. The arrows indicate the border between the brown-black part of the rachis and the green tip; full arrow for adaxial and broken arrow for abaxial side. A–E = subsp. *presolanense.* A = TR-1526 = JDL-A6 = experimentally produced from spores of *A.* × *adulteriniforme* (TR-823) by J.D. Lovis (in litt. 9. VI. 1965), afterwards cult. in Basel; B, C = wild collections, Presolana (Ras-351 and Ras-361); D = two fronds of wild collection, Poschiavo (R. Göldi s.n. = TR-5851); E = two fronds raised from first collection, Presolana (F. Mokry s.n.) = TR-5082-prog., cult in Basel. F = hybrid Ras-363 = *A.* × *trichomaniforme* nothosubsp. *calcicolum* after cult. in Basel (TR-5843, pressed 8. IX. 1983); G = *A. trichomanes* subsp. *quadrivalens,* Ras-392 from the immediate vicinity of the hybrid, cult. in Basel (TR-5842, pressed 15. X. 1984); H = subsp. *adulterinum,* two fronds of wild collection Ras-395, 28. IX. 1968 from Finero, Prov. Novara, Italy.

ecological demands. The same may therefore be expected for *A. adulterinum* subsp. *presolanense* (Tr'Tr'ViVi) and subsp. *adulterinum* (TrTrViVi). We plan to check this experimentally.

So far only one colony of subsp. *presolanense* has been found on the Presolana. In the meantime, the locality has been revisited by P. & E. Aleksejew in Sept. 1981, by F. Mokry on 12. 9. 1981, and by H. & K. Rasbach on 8.–9. 9. 1983 (see photograph fig. 3). The latter spent two days in searching the steep rocks (as far as possible), and a total of ca. 50 plants could be detected between ca. 1200–1220 m alt. Other ferns in the vicinity were: *A. ruta-muraria* L., *A. trichomanes* subsp. *quadrivalens* D. E. Meyer, *A. viride* Hudson, and a small specimen of the hybrid *A. adulterinum* subsp. *presolanense* × *A. trichomanes* subsp. *quadrivalens* = Ras-363 (see below). H. Rasbach and P. Aleksejew recorded the following accompanying phanerogams typical for this region: *Aquilegia einseleana* F. W. Schultz, *Saxifragra vandellii* Sternb., *Rhodothamnus chamaecistus* (L.) Reichenb., *Rhododendron hirsutum* L., *Primula glaucescens* Moretti, *Paederota bonarota* L., *Campanula raineri* Perpenti, *Physoplexis comosa* (L.) Schur, and *Telekia speciosissima* (L.) Less.

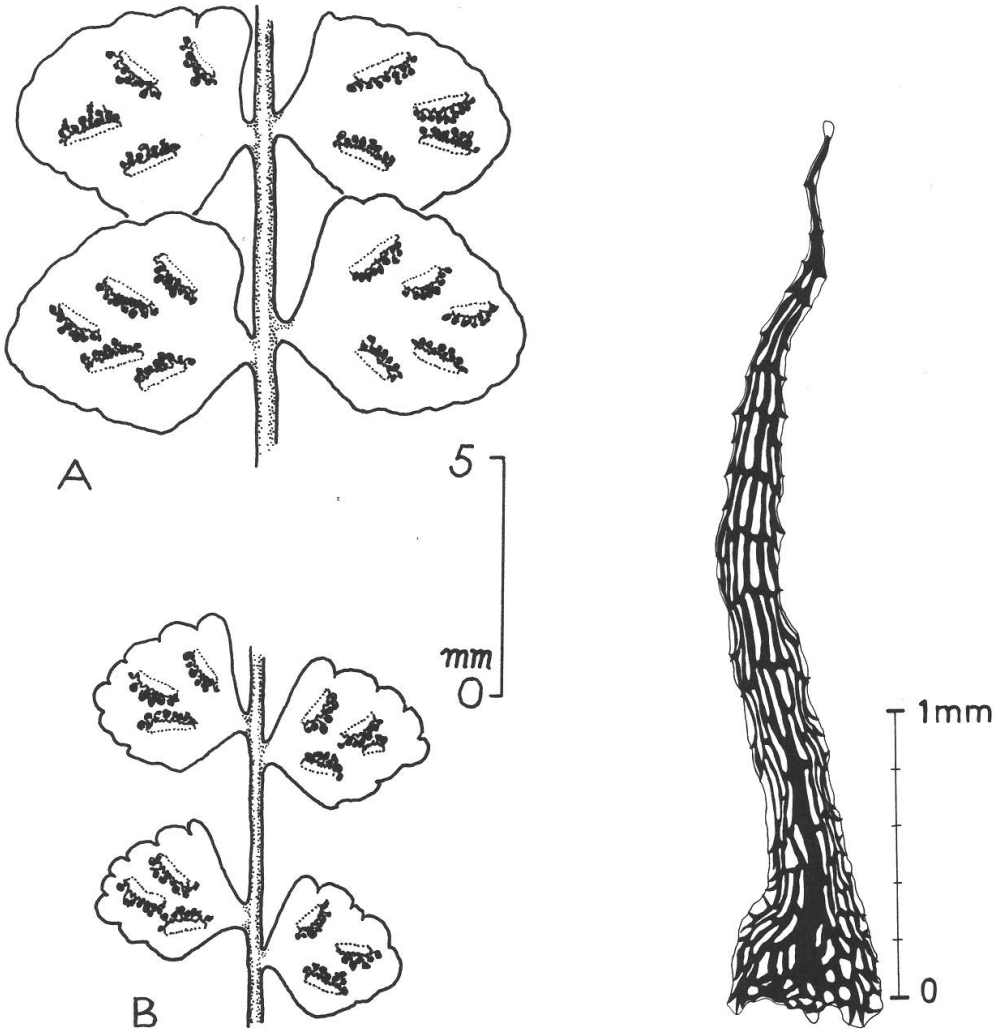
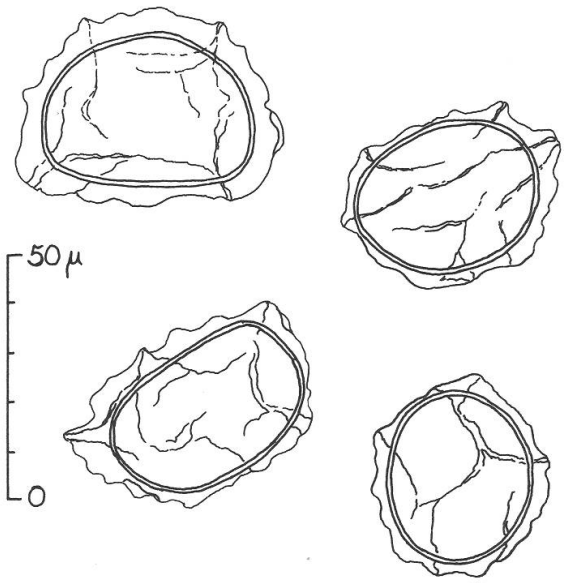


Fig. 5. A, B = details of pinnae: A = *Asplenium adulterinum* subsp. *presolanense* Ras-362; B = subsp. *adulterinum* Ras-392. C = rhizome scale of subsp. *presolanense* Ras-361.



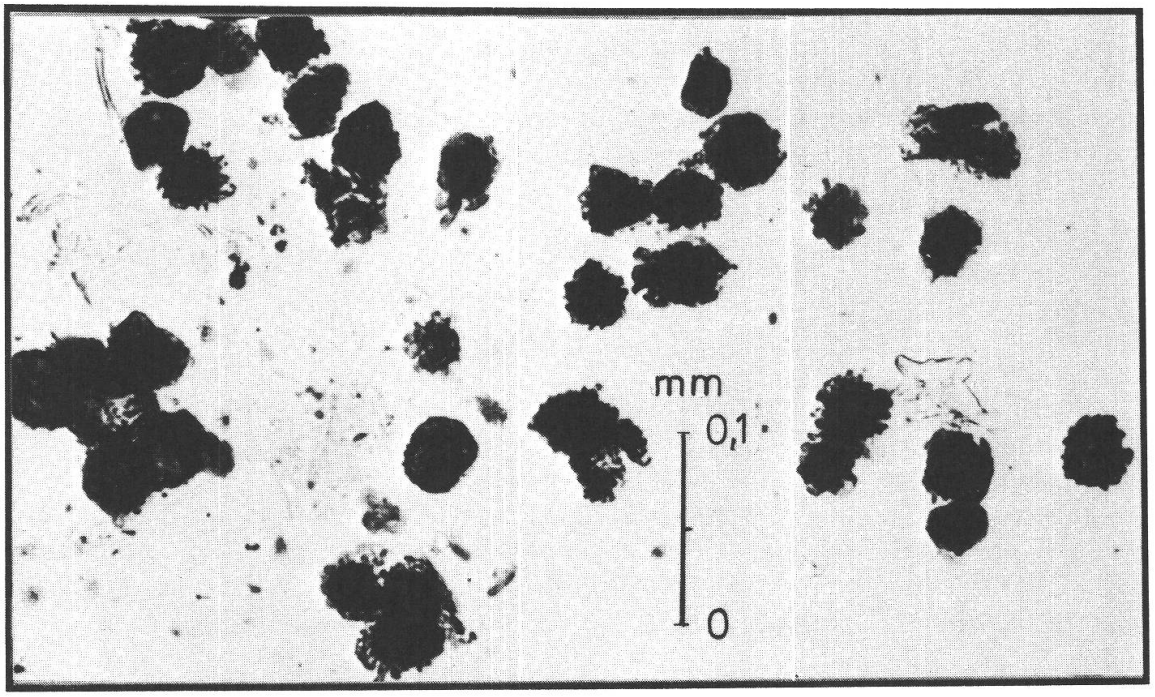


Fig. 6. Above: Spores of *Asplenium adulterinum* subsp. *presolanense* Ras-351 (drawing H.R.) with exospore as seen in the light microscope and irregular perispore. Below: Sporangial content, abortive material of the hybrid Ras-363 after cultivation in Basel (TR-5843).

More recently (16. 10. 1983) another small colony (ca. 4 or 5 plants) was found by R. Göldi in the Val di Gag (Poschiavo, Kt. Graubünden), Switzerland, i.e., also on the southern slope of the Alps, at ca. 1300 m alt; but this time on mica schist (see below). Mr. Göldi gave us two fronds of his collection (see fig. 4D) and living progeny (TR-5851) could be raised from their spores. The plants had the same prostrate habit when grown in pots and were morphologically quite similar to those from the Presolana. Where they grew the rocks consisted of minerals (mica schist with quartzite inclusions)

usually classified as acidic. Nevertheless the material contained appreciable amounts of soluble salts (see under 5) and we suspect that even limestone inclusions might occur in the vicinity, as *A. viride* was growing not far away.

Note 2. It is of great interest that plants which, in our opinion, are conspecific with *A. adulterinum* subsp. *presolanense* have recently been found in British Columbia (Canada) by Adolf Češka. He is soon to publish his finds but has already sent us pressed material from which we could raise living progeny. In cultivation the Canadian plants show the same characters as the Italian and Swiss ones, including their prostrate habit. Only the pinnae are less imbricate. This is the first report of *A. adulterinum* (sensu lato) from outside of Europe.

3. Possible formation

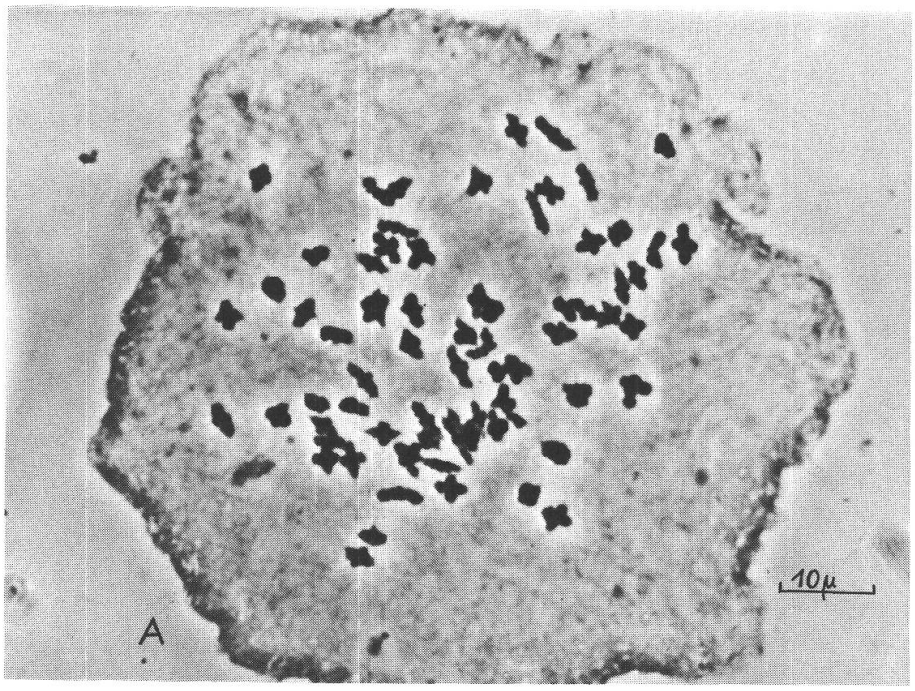
In spite of careful search at the station of subsp. *presolanense* on the Presolana, no *A. trichomanes* subsp. *inexpectans* could be found in the vicinity. We cannot exclude that it exists somewhere in the neighbourhood, although it has not yet been reported from Italy. We therefore have the impression that subsp. *presolanense* has not formed recently at the locus classicus, but represents an old relict, like *Saxifraga presolanensis* Engler and other rare old endemics reported from the Presolana and a few other famous similar mountains (Pitschmann & Reisigl 1959) in this part of the southern slope of the Alps which was never covered by ice during the different glaciation periods since the Tertiary. It will surely be advisable to search for this little fern in other localities.

4. Hybrid

As mentioned above, a hybrid (Ras-363) was collected during the careful search on the Presolana. This hybrid was in morphology (fig. 4 F) and behaviour at meiosis (Fig. 8) similar to the hybrid *A.* ×*praetermissum* Lovis, Melzer & Reichstein = *A. adulterinum* × *A. trichomanes* subsp. *quadrivalens* (Reichstein 1981: 109, 114). According to the new Code (E. G. Voss et al. 1983) the valid name for the latter must be *A.* × *trichomaniforme* Woynar nothosubsp. *praetermissum* (Lovis, Melzer & Reichstein) Mokry, Rasbach et Reichstein (1986). We describe the new hybrid according to the new rules of the Code as:

Asplenium × *trichomaniforme* Woynar nothosubsp. *calcicolum* Rasbach & Reichstein, hybr. nova = *A. adulterinum* Milde subsp. *presolanense* Mokry, Rasbach & Reichstein × *A. trichomanes* L. subsp. *quadrivalens* D. E. Meyer. – *Typus:* Ras-363, 9. 9. 1983, leg. H. & K. Rasbach. Holotype G, Isotypes (one frond each) Z, FI. – *Locus:* Italy, Prov. Bergamo, northern slopes of the Presolana, tributary valley of the Valle di Scalve, shady limestone rocks above Còlere at ca. 1200 m alt., between the parents. – *Derivatio:* Named after the kind of rock on which the hybrid was growing. – *Diagnosis:* Recedit a nothosubspecie *praetermisso* pinna terminali saepe latiore, pinnis lateralibus crebrioribus, saepe imbricatis, et habitatione: rupes calcareae nec ophiolithicae.

Description: The hybrid was collected living and could be examined in detail after cultivation (TR-5843). Nothosubsp. *calcicolum* is tetraploid with ca. 36 paired and 72 univalent chromosomes at meiosis (fig. 8 B, B′) similar to nothosubsp. *praetermissum.*



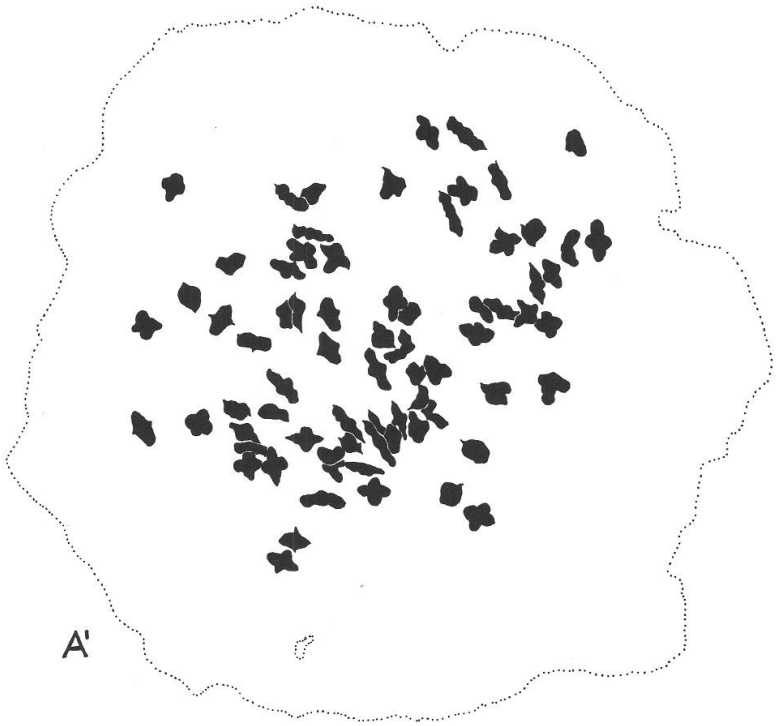


Fig. 7. Cytology of *Asplenium adulterinum* subsp. *presolanense* in cultivated plant TR-5082 raised from spores collected by F. Mokry (31. VII. 1979), showing a spore mother cell at meiosis (metaphase I) with 72 pairs of chromosomes (det. H.R.) A = photograph, A′ = explanatory diagram.

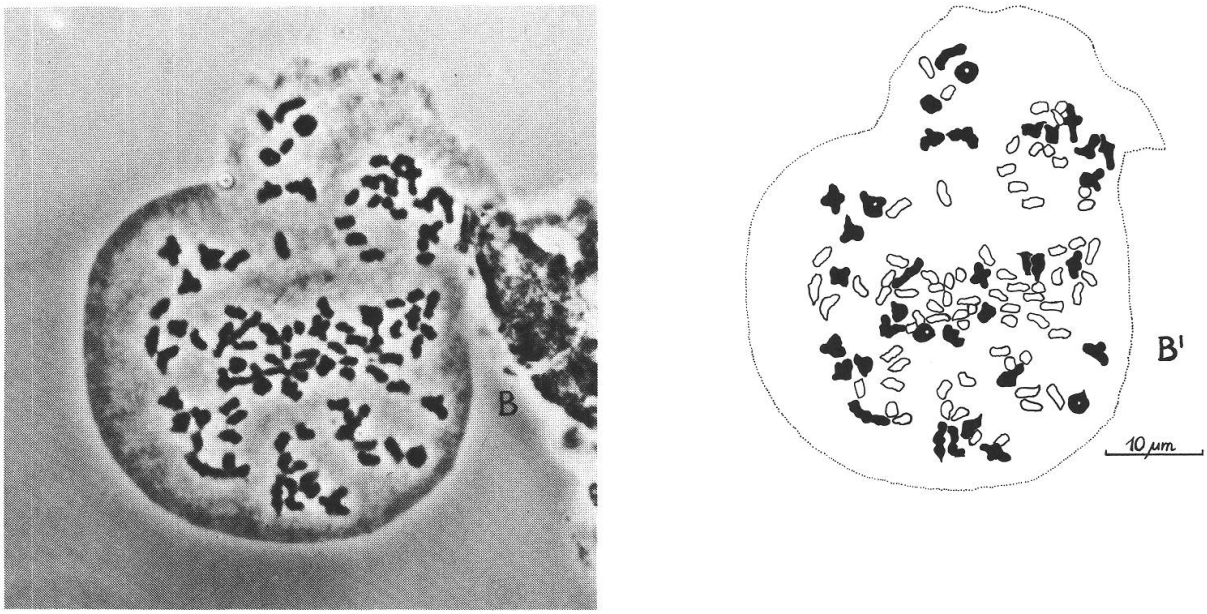


Fig. 8. Cytology of the hybrid *Asplenium trichomaniforme* nothosubsp. *calcicolum,* Ras-363 after cultivation in Basel (TR-5843) showing a cell at meiosis (metaphase I). B = photograph, B′ = explanatory diagram with bivalent chromosomes black and univalents in outline, showing 36^{II} and 72^{I} (det. H.R.).

In morphology it differs slightly from the latter by sometimes wider terminal pinnae and more crowded, often imbricate lateral pinnae (fig. 4F). Both parents may be responsible for this character. Not only *A. adulterinum* subsp. *presolanense* has usually more imbricate pinnae than subsp. *adulterinum,* but the tetraploid *A. trichomanes* subsp. *quadrivalens* (Ras-348 = TR-5841-A, giving 72^{II} at meiosis), growing near the hybrid, also has more closely inserted, often imbricate pinnae (fig. 4G), if compared with the common forms of subsp. *quadrivalens* from most of the northern Alps.

5. Chemical and mineralogical examination of rock

A piece of rock collected by F. Mokry at the locus classicus of subsp. *presolanense* was analysed by Dr. H. G. Seiler (Institute of Inorganic Chemistry of the University of Basel) with atomic absorption spectrometry and found to be essentially calcium carbonate, with some impurities including iron but no more than traces of magnesium.

A piece of rock from the station in the Puschlav Valley collected by R. Göldi was examined by Prof. W. Wimmenauer (Mineralogisch-petrographisches Institut der Universität, Freiburg i/Br., Federal Republic of Germany). After having a thin section made he identified the rock as a quartz-rich micaschist with quartz and muscovite as main components (in litt. 29. 3. 1985). Another piece of the same rock was used by Dr. H. G. Seiler for chemical analysis of inorganic ions available to plants as follows:

10 g of stone was broken into small pieces and extracted for 2 hours at 70 °C with 50 ml each of the following solvents (one after the other).

a. distilled water,

b. 10% ammonium acetate (NH_4OAc),

c. 1 molar hydrochloric acid (HCl).

The three extracts were analysed for Magnesium, Calcium, Potassium, and Sodium, and semiquantitatively for anions, with the following results (amounts in mg per g rock):

Extract	Mg	Ca	K	Na	Predominant anion
a	0.43	0.04	0.16	0.1	Sulfate (SO_4^{-2})
b	0.56	0.06	0.06	0.02	Not checked
c	0.65	0.74	0.02	0.01	Not checked

No carbonate was found. The most conspicuous result is the high content of Mg, K, and Sulfate in those parts of the rock (solutions a and b) which are available to plants.

We express our gratitude to Professor K. U. Kramer (Zürich, Switzerland) for translating the diagnoses into Latin and for his help in correcting the manuscript; to Mr. A. Češka (Victoria, British Columbia, Canada) for sending us pressed plants from British Columbia and giving us his permission to report on them; to Mr. R. Göldi (St. Gallen, Switzerland) for fronds and a piece of rock from the Val Poschiavo; to Dr. K. Rasbach (West Germany) for photographs; to Dr. H. G. Seiler, Institute of Inorganic Chemistry of the University of Basel (Switzerland) for analysing the two fragments of rock; and to Prof. W. Wimmenauer, Institute of Mineralogy, University of Freiburg i.Br. (West Germany) for examining the rock fragment from Poschiavo.

Zusammenfassung

Asplenium adulterinum Milde ist ein kleiner Farn, der nahezu ausschließlich auf Magnesit, Serpentinit und anderen ultrabasischen Gesteinen wächst. Er ist nur aus Nord-, Zentral- sowie Ost-Europa bekannt. Wir beschreiben hier eine neue Unterart als subsp. *presolanense,* die zuerst in Nord-Italien auf der Presolana in den Bergamasker Alpen, dann auch in der Schweiz, im Puschlav (Kt. Graubünden) gefunden wurde. Sie unterscheidet sich von der subsp. *adulterinum* durch schlafferen Wuchs, weniger gekerbte und näherstehende (oft überlappende) Fiedern, breitere Endfiedern und vor allem durch die Tatsache, daß sie auf schattigen Kalk- oder Glimmerschieferfelsen wächst. Bisher ist sie aus Europa nur von der Presolana sowie aus dem Puschlav bekannt; sie ist aber bereits früher durch spontane Chromosomenverdoppelung aus der diploiden Hybride *A.* × *adulteriniforme* Lovis, Melzer & Reichstein unter experimentellen Bedingungen erhalten worden.

Résumé

Asplenium adulterinum Milde est une petite fougère connue presque exclusivement des substrates de magnésite, serpentinite ou d'autres rochers ultrabasiques en Europe septentrionale, centrale et orientale. Nous décrivons un nouveau taxon comme subsp. *presolanense* provenant de la Presolana (Alpes Bergamasques) en Italie septentrionale, trouvé aussi en Suisse dans le Val Poschiavo (Ct. des Grisons). Il se distingue de la subsp. *adulterinum* par son port plus lâche avec des feuilles appliquées au rocher, par ses pennes moins crénulées et plus proches l'une de l'autre (souvent imbriquées), la penne terminale souvent plus large, et surtout par croissant sur des rochers calcaires

ou micaschists siliceuses ombragés. Jusqu'à présent, il est connu en Europe seulement de la Presolana et du Val Poschiavo, mais il était déjà obtenu sous conditions expérimentelles par un redoublement spontané des chromosomes dans l'hybride naturel *A.* × *adulteriniforme* Lovis, Melzer et Reichstein.

Literature

Jalas J. & Suominen J. 1972. Atlas Florae Europaeae, 1. Helsinki.
Lovis J. D. 1964. The taxonomy of *Asplenium trichomanes* in Europe. Brit. Fern Gaz. 9: 147–160.
Lovis J. D. 1968. Artificial reconstruction of a species of fern, *Asplenium adulterinum.* Nature 217 (No. 5134): 1163–1165.
Lovis J. D., Melzer H. & Reichstein T. 1965. *Asplenium* × *adulteriniforme* hybr. nov. = diploides *Asplenium trichomanes* L. × *viride* Hudson. Bauhinia 2: 231–239, 315–321.
Lovis J. D. & Reichstein T. 1968 a. Über das spontane Entstehen von *Asplenium adulterinum* aus einem natürlichen Bastard. Naturwiss. 55: 117–220.
Lovis J. D. & Reichstein T. 1968 b. Die zwei *Asplenium trichomanes* × *viride*-Bastarde und ihre Fähigkeit zur spontanen Chromosomenverdopplung. Bauhinia 4: 53–63.
Meyer D. E. 1958. Zur Zytologie der Asplenien Mitteleuropas (XVI–XX) Ber. Deutsch. Bot. Ges. 71: 16.
Milde J. 1865. Die höheren Sporenpflanzen Deutschlands und der Schweiz. Leipzig.
Pitschmann H. & Reisigl H. 1959. Bilderflora der Südalpen. Mit Illustrationen von H. Schiechtl. Stuttgart.
Reichstein T. 1981. Hybrids in European Aspleniaceae (Pteridophyta). Bot. Helv. 91: 89–139.
Voss E. G. et al. 1983. International Code of Botanical Nomenclature adopted by the thirteenth International Botanical Congress, Sydney, August 1981. Utrecht-Antwerpen-The Hague-Boston.