

Zeitschrift: Candollea : journal international de botanique systématique = international journal of systematic botany

Herausgeber: Conservatoire et Jardin botaniques de la Ville de Genève

Band: 39 (1984)

Heft: 2

Artikel: Typification of *Asplenium varians* Wall. ex Hook. & Grev. (Aspleniaceae, Pteridophyta) : studies in *Asplenium* for "Flora Iranica" : 5

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DOI: <https://doi.org/10.5169/seals-879930>

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Typification of *Asplenium varians* Wall. ex Hook. & Grev. (Aspleniaceae, Pteridophyta). Studies in *Asplenium* for "Flora Iranica": 5

For the fourth article in this series see Fraser-Jenkins & Reichstein, *Candollea* 37: 339-347. 1982.

ANNE SLEEP
&
TADEUS REICHSTEIN

ABSTRACT

SLEEP, A. & T. REICHSTEIN (1984). Typification of *Asplenium varians* Wall. ex Hook. & Grev. (Aspleniaceae, Pteridophyta). Studies in *Asplenium* for "Flora Iranica": 5. *Candollea* 39: 675-691. In English, German abstract.

The name *Asplenium varians* Wall. ex Hooker & Greville is shown to have been applied to a complex of closely related but distinct species which is distributed through eastern and southern Asia to tropical and southern Africa. Reasons are given for designating as the lectotype of *A. varians* a Wallich specimen from Nepal preserved in the Hooker herbarium at Kew. This specimen has been compared in gross morphology and spore size with cytologically determined diploid and tetraploid material of the *A. varians* complex. It appears to be conspecific only with plants of tetraploid chromosome number from north-western India and equivalent material has not yet been found either within the area covered by the *Flora Iranica* or in Japan. In contrast, diploid specimens from Japan, Taiwan and the eastern Himalayas, previously treated in herbaria and floras as *A. varians*, have been identified as *A. tenuicaule* Hayata. Other members of the complex so far distinguished include *A. varians* subsp. *fimbriatum* (Kunze) Schelpe, a tetraploid from South Africa, and an as yet unnamed diploid from the western Himalayas. Consideration is given to the problem of *A. laciniatum* Don, an earlier name than *A. varians* but one based on a type specimen which, although undoubtedly belonging to the *A. varians* complex, is insufficient for positive specific determination within this difficult group. In view of the unsatisfactory nature of the type specimen we recommend that the name *laciniatum* should be rejected. Work on this group is continuing and it is expected that several additional members of the *A. varians* complex will be described as new species in the near future.

ZUSAMMENFASSUNG

SLEEP, A. & T. REICHSTEIN (1984). Typifizierung von *Asplenium varians* Wall. ex Hook. & Grev. (Aspleniaceae, Pteridophyta). Studien in *Asplenium* für "Flora Iranica": 5. *Candollea* 39: 675-691. Auf Englisch, Deutsche Zusammenfassung.

Der Name *Asplenium varians* Wall. ex Hook. & Grev. wurde bisher für einen Komplex von mehreren, nahe verwandten aber verschiedenen Arten verwendet, die in Ost- und Süd-Asien, sowie im tropischen und südlichen Afrika heimisch sind. Es wird dargelegt, warum wir einen bestimmten Beleg von Wallich aus Nepal als Lektotypus bezeichnet haben, der im Hooker Herbar in Kew liegt. Dieser Beleg wurde in seiner Morphologie und Sporengröße mit cytologisch kontrollierten diploiden und tetraploiden Sippen des *A. varians* Komplexes verglichen. Er erwies sich als conspezifisch mit einer tetraploiden Sippe, die wir aus NW Indien hatten. Gleiches Material wurde weder in Gebiet der *Flora Iranica* noch in Japan gefunden. Dagegen konnten wir diploide Pflanzen aus Japan, Taiwan und dem Ost Himalaya, die bisher meistens auch als *A. varians* behandelt wurden, als *A. tenuicaule* Hayata identifizieren. Andere Sippen des Komplexes sind *A. varians* subsp. *fimbriatum* (Kunze) Schelpe aus Südafrika, die sich ebenfalls als tetraploid erwies sowie eine noch unbenannte diploide Sippe aus dem West Himalaya. Wir prüften auch das Problem von *A. laciniatum* Don. Der Name ist älter als *A. varians*, aber der Typus (ein einziges Blatt mit sehr wenig Sporen) ist zwar sicher ein Vertreter des *A. varians* Komplexes, er ist aber für eine sichere Identifizierung in dieser schwierigen Gruppe ungenügend. Wir lehnen es daher ab, den lange eingebürgerten Namen *A. varians* durch *A. laciniatum* zu ersetzen und verwerfen den letzteren.

Abbreviations for herbaria follow Holmgren, Keuken & Schofield, *Index Herbariorum* I. 7th ed. Utrecht, 1981. T. R. indicates herb. T. Reichstein, Basel. The transliterations of STEWART (1972) are used for the names of districts and localities in present Pakistan (e.g. 'Kurram') but the original spelling is given in quotations from relevant works (e.g. 'Kuram', in Hope).

1. Introduction

Records of *Asplenium varians* Wall. ex Hook. & Grev. are known from Afghanistan, Pakistan, India (where it is common in the Himalayas), Nepal, Ceylon, Thailand, China, Taiwan, Korea, Japan, and South Africa. A search, initially for specimens reported to come from localities within the compass of the *Flora Iranica* (ed. Rechinger, 1964—), has revealed a bewildering assortment of morphological types incorporated under this name in herbaria. The establishment in cultivation and subsequent cytological investigation of collections of *A. varians* from several known geographical sources have shown this name to have been applied to a complex of closely related but distinct species. In order to clarify this difficult group it has been necessary first to typify the name *A. varians* Wall. ex Hook. & Grev.

The technical methods employed are now standard but details regarding spore measurement will be found in Section 4.

2. Typification of *Asplenium varians* Wall. ex Hook. & Grev.

The original description of *Asplenium varians* appears in fascicle IX of Hooker and Greville's *Icones Filicum*, which, as far as can be established, appeared c. 1829-1830 (see note below).¹ The description is accompanied by a line drawing (Tab. 172, reproduced in Fig. 1) showing one large single frond, a small whole plant, a single pinna, spores and sporangia. Hooker and Greville give the following collection details in the description which accompanies this illustration: 'Aspidium [sic]² varians. Wallich, MSS in Herb. Hook. Hab. In rupibus Nepaliae. Jan. 1818. Nom. vern. "Dawecow" Wallich.'

In the Hooker herbarium at Kew there is a sheet (Fig. 2) which bears a label consistent with the above-mentioned information and which most probably represents the type material of *Asplenium varians*. This sheet bears eight specimens (now lettered A-H by A.S.) of similar morphology but apparently from three different origins, and three handwritten labels. One of the labels, bearing the words 'Simlah, Edgeworth' and positioned between two specimens (F and G) in the lower left-hand corner of the sheet, presumably refers to those specimens. Dr. B.S. Parris (pers. com., 2.9.1981) gave us the following information about it, provided by Dr. A. Radcliffe Smith: 'The wording "Simlah, Edgeworth" (bottom left) may be attributable to J. E. Planchon, who worked as an assistant to Sir W. J. Hooker at one time, but this is impossible to prove at present.' A second label, bearing the words 'Asplenium, Cape of Good Hope, Lady Dalhousie', is positioned towards the bottom right-hand corner, not far below the plant labelled H by A. S. It seems reasonable to associate this label with this particular specimen. Dr. Parris' information is that the handwriting is unattributable but is unlikely to be that of Lady Dalhousie.

There remain the five specimens A-E and the large label (Fig. 3) in the bottom right-hand corner. These specimens are, in our view, the original collection mounted on this sheet and we presume the main label refers to them. It is impossible to know whether this label accompanied the specimens when they arrived or was copied subsequently from information received with the collection. In order to throw light on this question, an attempt was made to identify the handwritings (four in all) on this label. The only positive information obtained was that the words 'Dr. Wallich', at the base of the label, are not a signature but are written in W. J. Hooker's hand. The words 'variens' and 'Wall.' have been added by two different writers. The rest of the label, namely,

¹BOIVIN (1950) gives the probable date of publication of fascicle IX of the *Icones Filicum* as '1830?'. However, there exists in Basel a complete set of individual fascicles of this work, with fascicle IX (which includes Tabula 172) bearing the printed date 1829. In this paper we therefore take the publication date of fascicle IX to be 1829.

²The title and legend are both given as 'Asplenium varians' and the word 'Asplenium' appears three times elsewhere in the description (twice preceding the word 'Aspidium'). We therefore assume that 'Aspidium' is an error.

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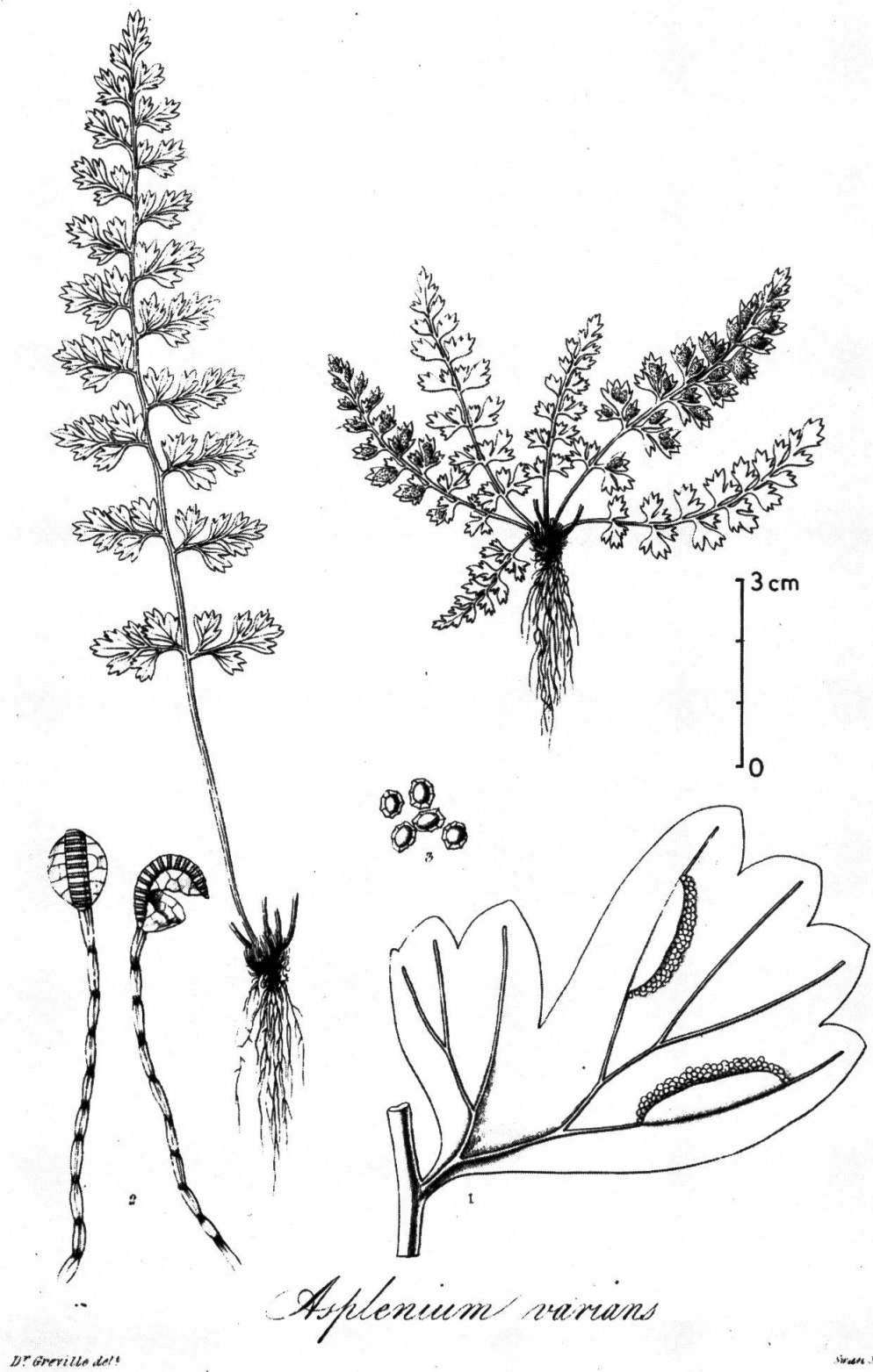


Fig. 1. — Reproduction of *Tabula 172* (slightly reduced) from HOOKER & GREVILLE (1829).



Fig. 2. — Sheet in Kew here identified as bearing the type material of *Asplenium varians*. Reduction \times ca. 2.5.

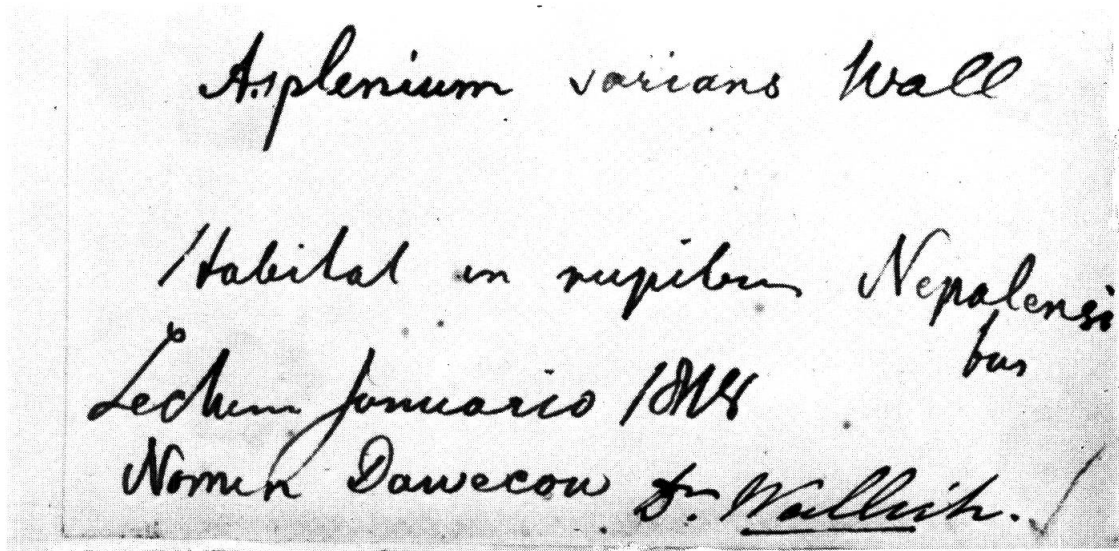


Fig. 3. — Label at the bottom right-hand corner of the Kew sheet discussed in the text. Actual size. Cf. collection details cited in HOOKER & GREVILLE (1829).

'*Asplenium*. Habitat in rupibus Nepalensibus. Lectum Januario 1818. Nomin. Dawecow', is written in a uniform style but the writer cannot be identified. According to Mr. Airy Shaw (Parris, pers. comm., 12.8.82) the writing is unformed and is probably that of a young person; he has seen similar labels elsewhere at Kew. The writing does not correspond with the hand of the Wallich catalogue.

Though the original details of this label as delimited above generally correspond with the descriptions given by Hooker and Greville in their 1829 publication, there are sufficient differences of detail between the text of the label and the collection details given, in both Latin and English, in the *Icones Filicum*, to allow for the possibilities either that Hooker and Greville were quoting from a different label or were paraphrasing the present label. The positive evidence, therefore, provided by the label is that the material to which it refers came from Nepal and was collected in 1818. We may, further, assume that the material was sent to Hooker by, or on behalf of, Wallich. The label alone does not suffice to prove that Hooker and Greville were actually working from this sheet when preparing their description of *Asplenium varians*.

However, another piece of evidence makes it almost certain that they were indeed working from the sheet under consideration: we observe that the large frond figured in the illustration (Fig. 1) accompanying the original description of *A. varians* (Hooker & Greville, 1829) bears such a striking resemblance to the single large and well pressed frond of plant B on our sheet that it could well be a representation of it. There is also considerable similarity between Hooker & Greville's illustration of a whole plant and specimen C. In view of the fact that two of the specimens on our sheet can, with some degree of confidence, be identified as the ones most probably used by Hooker and Greville to illustrate their description of *Asplenium varians*, we conclude that they used this sheet as the basis of their publication of the name *Asplenium varians*, and that it is, therefore, the type sheet. Of the five specimens (A-E) which we believe to be attributable to the Wallich collection from Nepal which constitutes the type material, one has to be designated as the lectotype. We propose to select specimen B for this purpose. Independent confirmation of our choice was received from both Professor K. U. Kramer (pers. comm., 20.9.1979) and Dr. Parris, and we quote here the appropriate passage of Dr. Parris' letter of 12.8.1982: 'It is possible to match in part the illustration in Hooker and Greville's *Icones Filicum* (No. 172) with the type sheet. The large single frond illustrated is almost certainly from plant B, while the small plant C is almost certainly the other plant illustrated. [...] The label at the bottom right-hand corner of the sheet applies to these two and a few other plants. Either B or C seems to me to be a good lectotype choice as both are recognizable in the illustration accompanying the original description.' In our opinion plant C should not be chosen as the lectotype. It is a small, probably young, plant and less well pressed than specimen B. We therefore hold to our designation of plant B as the lectotype of *Asplenium varians* Wall. ex Hook. & Grev. (see Fig. 4).



Fig. 4. — Specimen B from Kew sheet. Natural size. Cf. Tabula 172 in HOOKER & GREVILLE (1829). We designate this plant as the lectotype of *Asplenium varians*.

It is interesting to note that although 'this small but very distinct species of *Asplenium* was amongst the earliest communications that we received from our generous friend Dr. Wallich' (*Icones Filicum*, IX, 1829), it could not, as has been pointed out by Mr. H. M. Burdet of Geneva, have been collected by Wallich personally because he arrived in Nepal only in December, 1820. Dr. Parris (pers. comm., 2.9.82) gave us additional information on this point, originating from Dr. A. R. Smith of Kew: 'There was a survey party in Nepal from 1816 onwards and Wallich's collector Kamrup (or Kamroop) and a collecting party probably went with them. Specimens received from this party by Wallich were sent to Sir E. J. Smith on 24.5.1819. Bharat Singh, one of Wallich's collectors, and another of Wallich's collectors based in Katmandu sent *Rhododendron* seed to Britain in 1818. I do not know the date of arrival at Kew of the material of *Asplenium varians*, but it could have been collected by either of these parties.' (See also de Candolle & Radcliffe-Smith, 1981: 327.)

3. Records of *Asplenium varians* from the area of *Flora Iranica*

The area covered by *Flora Iranica* extends eastwards to the Himalayas and includes the whole of Afghanistan as well as that part of Pakistan which comprises the region to the west of the Indus, and, in the north, the mountainous districts of Chitral, Dir and Swat. Since we had identified the type material of *Asplenium varians* as a Himalayan fern described from Nepal, it seemed probable that the reports of *A. varians* from Afghanistan were referring to the same species.

Two specimens, collected by J. E. T. Aitchison from the Kurram valley (before 1947 in Afghanistan, now probably in Pakistan), which is within the area of *Flora Iranica*, and labelled *A. varians*, have been found: the first, Aitchison No. 256, in both K and P, is not compatible with the type specimen of *Asplenium varians* on morphological grounds and has been identified as *A. nesii* Christ by Ching (see CHING & REICHSTEIN, 1981). The second specimen, found in the herbarium of the Manchester Museum by C. R. Fraser-Jenkins, is also morphologically distinct from the type specimen of *Asplenium varians*: it has been described as *Asplenium aitchisonii* by Fraser-Jenkins & Reichstein (1982). It is a different species, a fact confirmed by cytological investigation (SCHNELLER & REICHSTEIN, in preparation). No specimen corresponding with the type specimen of *A. varians* can yet be shown to come from the area of *Flora Iranica*, despite the references to this species which appear in the literature. *A. varians* has been reported as occurring in the Kurram valley by AITCHISON (1881: 11), HOPE (1901: 667, or reprint, c. 1970: 141) and STEWART (1957: 17 and 1972: 18). HOPE, and STEWART (1972) additionally give references to the specimens on which their statements are based, and we quote the relevant passage from Hope:

'15. *Asplenium varians*.

AFGHAN: Kurram Valley, Aitch, No. 409, 1899: "not common"; Peiwar Kotal 8000', Collet, 1879.'

Despite extensive searches made by T. R. in BM, CAL, DD, E, K, P and other herbaria the two sheets 'Aitchison No. 409' and 'Collet, 1879' have failed to come to light, although Aitchison collections of *A. pseudofontanum* (see REICHSTEIN & SCHNELLER, 1982) are preserved in various herbaria. Without herbarium specimens to substantiate the literature records we must, for the time being, remain doubtful whether material which is certainly identical with the type specimen of *A. varians* here defined has yet been found in the *Flora Iranica* area.

4. Cytological investigation of *Asplenium varians*

While appearance alone is sufficient to distinguish from the type material some species (e.g. *A. nesii*, *A. aitchisonii*) previously assigned to *A. varians*, others have only been shown to be different in cultivation or as a result of experimental hybridization. In the first instance it has been the morphological and cytological examination of living plants ascribed to *A. varians* and obtained from different geographical localities that has been instrumental in clarifying what is a very complex picture, providing information about the probable chromosome number of the type specimen and thus enabling further species to be distinguished from it with certainty.

In the literature there are many reports of chromosome counts of material ascribed to *A. varians*. Japanese plants appear to be uniformly diploid (KURITA, 1960; KAWAKAMI, 1970; MITSUI, 1975, and own counts) but chromosome counts reported for material attributed to *A. varians* from India show the presence of both diploid and tetraploid plants. MEHRA & BIR (1957), BIR (1959, 1962, 1963, 1966-67) and BIR & SHUKLA (1967) have all reported diploid counts from the western Himalayas and from southern India (BIR, 1965), but both diploids and tetraploids from the eastern Himalayas (BIR, 1960, 1963 and 1966). A tetraploid count has also been reported from Nepal (central Himalayas) by ROY & al., (1971). The name *A. varians* thus clearly conceals a species-complex including at least two cytotypes.

Living material is an invaluable aid in the recognition of closely related or similar species, and in view of the existence of a complex comprising different cytotypes it was desirable to establish in cultivation plants assigned to *Asplenium varians* from as many localities as possible. At the outset of this investigation the only material of this group that we had in cultivation was *A. varians* from Japan. Living plants were raised from spores from dried material, originally of our own collection (AS/443, from Ryusendo cave, Iwaizumi, Aomori-ken, Japan), which was subsequently supplemented by further material received from correspondents. These Japanese plants were small in size and of delicate appearance, and cytological examination showed that they were, as expected, diploid.

In view of the fact that the type specimen of *A. varians* was collected in Nepal it was particularly important to obtain for comparison living material for cultivation from the Himalayan region. Through the co-operation of Dr. S. P. Khullar and C. R. Fraser-Jenkins, it proved possible to raise living plants from spores from north-western India and establish them in cultivation. This Indian material was different in appearance from our Japanese plants but much closer to the frond of *A. varians* figured by HOOKER & GREVILLE (1829: Tab. 172). In addition to the earlier reports of two cytotypes from the eastern Himalayas (BIR, 1960, 1963, 1966), cytologically determined material obtained from Dr. Khullar showed that both diploids and tetraploids are to be found in north-western India also. In view of the existence of two cytotypes in both the eastern and the western Himalayas, and the single report of a chromosome count from Nepal (ROY & al., 1971) which indicated that at least the tetraploid grew there, it was important to try to establish the ploidy of the type material discussed above. In morphology the lectotype (Fig. 4) matched closely the living plants of one particular tetraploid strain of *A. varians* (Fig. 5) from northern India that we had established in cultivation (TR 4610). This culture, which we elected to use as a standard, could be distinguished from plants of the diploid cytotype from northern India by small but constant morphological differences; although obvious in living material, these differences are often not readily apparent on old or poorly pressed herbarium specimens. Cytotypes can, however, often be distinguished by their spore size, and, provided sufficient spores are available, measurements of spore length can be used to advantage on herbarium material. In the case of *A. varians* a difference in the spore sizes of the diploid and tetraploid cytotypes recorded from northern India had been pointed out by BIR (1966-1967), and the usefulness of this character was confirmed by our spore studies on the cytologically determined living material that we had in cultivation. Measurements of spore length thus gave us the necessary basis to compare our living plants of the *A. varians* complex from northern India with the herbarium specimen constituting the lectotype.

We have found that the most satisfactory indication of degree of ploidy is given by precise measurements of exospore length under the high power of the microscope. The exospore is clearly visible as an elliptical line (surrounded by the irregular perispore, which is disregarded for the purposes of measurement) in spores which have been embedded in Canada Balsam, de Faure's gum chloral or similar mountants. We have recorded an exospore length range of (24-)27-33(-36) μm in the diploid and a range of (27-)33-36(-39) μm in the tetraploid from spores mounted in Canada Balsam. The figures without brackets give the range for c. 90% of the spores, while the figures in brackets give the lower and upper limits. We have found that the observed upper limit is a much more reliable basis for distinction than the lower limit, provided that no foreign spores are present as contaminants. Only fully mature, undamaged spores in side view are measured.

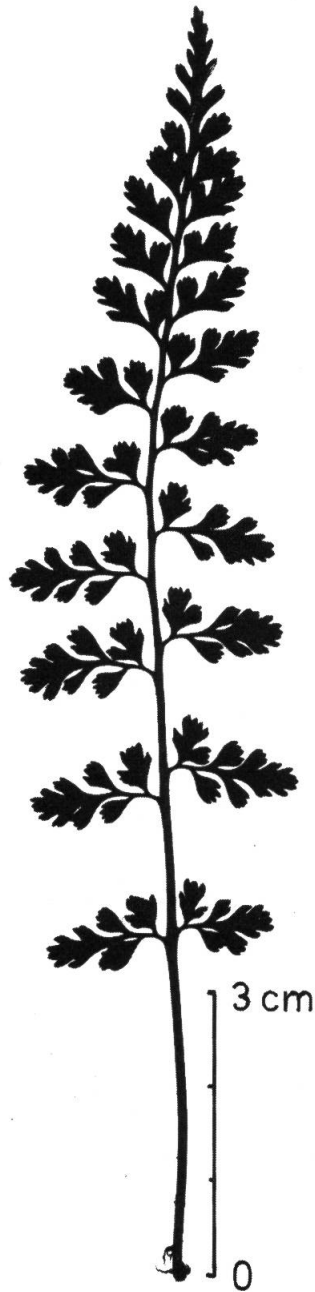


Fig. 5. — *TR 4610*. Silhouette of a frond from our standard tetraploid strain of *A. varians* from north-west India (Himachal Pradesh: ca. 4 km N.W. Naini Khad, 1500 m, roadside, *leg.* C. R. F-J. No. 6668, 30.8.1977). Raised in Basel from spores sown 2.3.1978. Tetraploid. Frond pressed 4.6.1984. Cf. specimen B (Fig. 4).

5. Ploidy level of the type material of *Asplenium varians*

Spore preparations of four of the five specimens shown above to have been collected for Wallich in Nepal and of the other three plants on the sheet were made. These preparations are deposited in Kew and are available to other workers. Sori were softened with a detergent solution (in this case 'Alcopol') and spores were mounted in de Faure's gum chloral. At least twenty spores from each specimen were measured in the manner described above and the range of exospore length recorded is given in Table I.

As can be seen from these results, the range of exospore length of all seven measured plants, including specimen B which we previously designated as the lectotype, corresponds closely with that of the cytologically attested tetraploid plants from northern India that we have in cultivation. We may conclude that the type specimen of *Asplenium varians* is tetraploid. The range of exospore length recorded from the six other spore-bearing plants on the sheet (three from Nepal, two from Simla and one from South Africa) indicates that these specimens may also be regarded as tetraploid.

We have already referred in Section 2 (p. 676) to a label on the type sheet giving the information 'Asplenium, Cape of Good Hope, Lady Dalhousie'; the specimen (H) to which this label presumably refers can most probably be assigned to *A. varians* subsp. *fimbriatum* (Kunze) Schelpe, which was described from South Africa in 1967. We have established material of this taxon in cultivation. It is close to our living plants of Indian *A. varians* in gross morphology and we have found that it too is tetraploid with a similar spore size (Rasbach & Reichstein, in preparation).

Spore ornamentation is also useful in separating the members of this difficult complex. Studies of spores of the *A. varians* group by means of the scanning electron microscope are currently being carried out in Ghent by R. Viane. Reports of his investigation will appear separately but in the meantime we include here SEM photographs of two spores from the lectotype of *Asplenium varians* (Fig. 6). Although the type material is very old and the spores are not in the best condition for this type of study, Mr. Viane (pers. comm., 25.6.1984) was able to say that in his opinion the spore architecture of the lectotype is consistent with that of our standard tetraploid strain of *A. varians* (TR 4610, see p. 683) that we have in cultivation.

6. The Japanese plants and their determination as *Asplenium tenuicaule* Hayata

A surprising result of our investigation of the *A. varians* complex and the identification of the type material of *A. varians* as a tetraploid Himalayan species is that the plant which has long been known in Japan as *A. varians* must now be assigned to another species. The fern flora of Japan is not only very rich but is one of the best known in the world. The members of the older generation who pioneered its study, however, were often working in isolation, generally with no possibility of studying the type specimens and other early collections of Asian plants preserved in European herbaria. When naming specimens they had to rely mainly on descriptions and these were often insufficiently precise. Japanese material ascribed to *A. varians* is diploid. We now know it to be distinct from the lectotype of *A. varians* in its gross morphology and small spore size. In fact Professor R. C. Ching of Peking had recognized the Japanese plants as a distinct taxon as long ago as 1934. Ching worked with Christensen and also visited many important herbaria in Europe and the U.S.A. during 1931 and 1932 and has expressed his opinion (pers. comm., 6.10.1978) that 'There is no true *Asplenium varians* growing in Japan. The plant called so there is *Asplenium subvarians* Ching in Christensen (1934: 38).' The Japanese material has now been found to correspond with a Formosan (= Taiwanese) fern described by HAYATA in 1914, a discovery which necessitates the replacement of Ching's *A. subvarians* by the earlier name of *Asplenium tenuicaule* Hayata. We were able to compare our living Japanese plants with *A. tenuicaule* through the kindness of Dr. C. M. Kuo of Taipei (who was at the time working in Zurich) who showed us a photograph of the type specimen of *A. tenuicaule* and provided material with fresh spores collected at the type locality (Mt. Arisan, Taiwan).

The general distribution of *A. tenuicaule* as communicated by R. C. Ching and found in herbaria is as follows: eastern Himalayas with eastern China and Tibet, Taiwan, Korea, Quelpaert (now Cheju Do, Korea) and Japan.

Full bibliographical details of *A. tenuicaule* and its most important synonyms are set out below.

| Specimen | Range | Mean | |
|----------|---------------|--------|---|
| A | 31.11-38.43µm | 34.5µm | Very few spores present |
| B | 31.11-40.26µm | 36.3µm | Many spores present |
| C | 31.11-38.43µm | 35.7µm | Many spores present |
| D | | | No spores present |
| E | 29.28-38.43µm | 33.7µm | Sporangia mostly dehisced; very few spores indeed. |
| F | 31.11-38.43µm | 33.1µm | Spores scattered; not many but sufficient to measure. |
| G | 29.28-36.60µm | 33.4µm | Spores scattered but sufficient to measure. |
| H | 31.11-42.09µm | 35.9µm | Much dirty material and only a few spores. |
| TR 4610 | 32.94-40.26µm | 36.6µm | Preparation mounted in gum chloral. |
| TR 4610* | 32.94-38.43µm | 35.8µm | Preparation mounted in Canada Balsam. |

*Denotes preparation in Canada Balsam. Other specimens all mounted in de Faure's gum chloral.

Table 1. — Spore measurements from specimens from type sheet of *Asplenium varians* Wall. ex Hook. & Grev.

¹One of us (T. R.) makes spore preparations in Canada Balsam, while A. S. generally uses de Faure's gum chloral. A series of measurements was made in Leeds using spores from a single sample which were mounted in each of the four following commercially available (from Hopkin & Williams, Chadwell Heath, Essex, England) liquid mountants, namely: neutral Canada Balsam, 'Euparal' (devised by the late Prof. G. Gilson of Louvain, Belgium), neutral mounting medium and de Faure's gum chloral. It was found that identical measurements of spore length were consistently obtained from the first three preparations (all resins insoluble in water), while the spores mounted in gum chloral were, on average, about 1µm bigger than the measurements taken in other mountants. This may be because gum chloral (a solution of gum arabic in chloral hydrate) is water soluble. In practice this slight difference is insufficient to invalidate conclusions regarding ploidy which are made from spore measurements. It should be noted that the spores from the type sheet of *A. varians* were mounted in gum chloral (these preparations are preserved at Kew). For purposes of comparison, measurements of the same number of spores from our standard tetraploid culture, TR 4610, mounted in gum chloral in Canada Balsam, are included in the above table.

²One generally records a higher mean from a good spore sample where many spores are present, and a lower one from a limited spore sample (e.g. Specimen E, above). In material where most of the sporangia have dehisced the sample for measurement will contain only the few remaining undispersed spores which are the smaller and weaker ones. This must always be kept in mind in interpreting the results from limited spore samples.

Asplenium tenuicaule Hayata, Icon. Pl. Formos. 4: 228. 1914 (with figure). Type from Arisan, Taiwan in TI.

- *Gymnogramma fauriei* Christ, *Bull. Herb. Boiss.* II 2 (1902): 561. Type from Japan in P(!).
- *Anogramma fauriei* (Christ) Christ in C. Christensen, *Index Filicum* (1905): 58. Type as preceding.
- *Asplenium subvariens* Ching in C. Christensen, *Index Filicum* suppl. III (1934): 38, not *Asplenium fauriei* Christ 1899. Type as preceding.
- *Asplenium varians* auct. (non Wall. ex Hook. & Grev.) e.g. Tagawa, M. 1962. *Coloured Illustrations of the Japanese Pteridophyta*. Hoikusha, Osaka, Japan; Ohwi, J. 1965. *Flora of Japan* (in English). Smithsonian Institution. Washington, U.S.A.; Nakaike, T. 1975. *Enumeratio Pteridophytarum Japonicarum*. University of Tokyo Press.
- *Asplenium anogrammoides* auct. (non Christ, 1908: 11, see note below), e.g. Fomin, A. 1930. *Flora sibirae et orientis extremi*. Leningrad.
- *Asplenium siobarense* Koidz., *Acta phytotax. geobot.* Kyoto 5(1): 50 (1936). Type as *Gymnogramma fauriei*.
- *Asplenium conmixum* Ching in *Flora Plant. Chinae bor.-orient.* 1: 36 (1958) with figure and diagnosis on p. 69.

Many herbarium specimens bearing the label 'A. anogrammoides' can easily be identified as *A. tenuicaule*; so also can some illustrations in the literature, for example *A. anogrammoides* depicted in Fomin (1930: 152-154 with Fig.). The name *A. anogrammoides* Christ is a synonym of *A. sarelii* Hooker, Christ's type specimen (in P) having been identified by Ching as *A. sarelii*. An isotype of *A. anogrammoides* Christ is preserved in BM; we have both examined this specimen and independently identified it as *A. sarelii*. The type material of *A. anogrammoides* (= *A. sarelii*) comes from the island of Quelpaert (now Chejü Do, Korea); it is interesting to note that *A. tenuicaule* grows on the same island: good specimens of it are preserved in G.

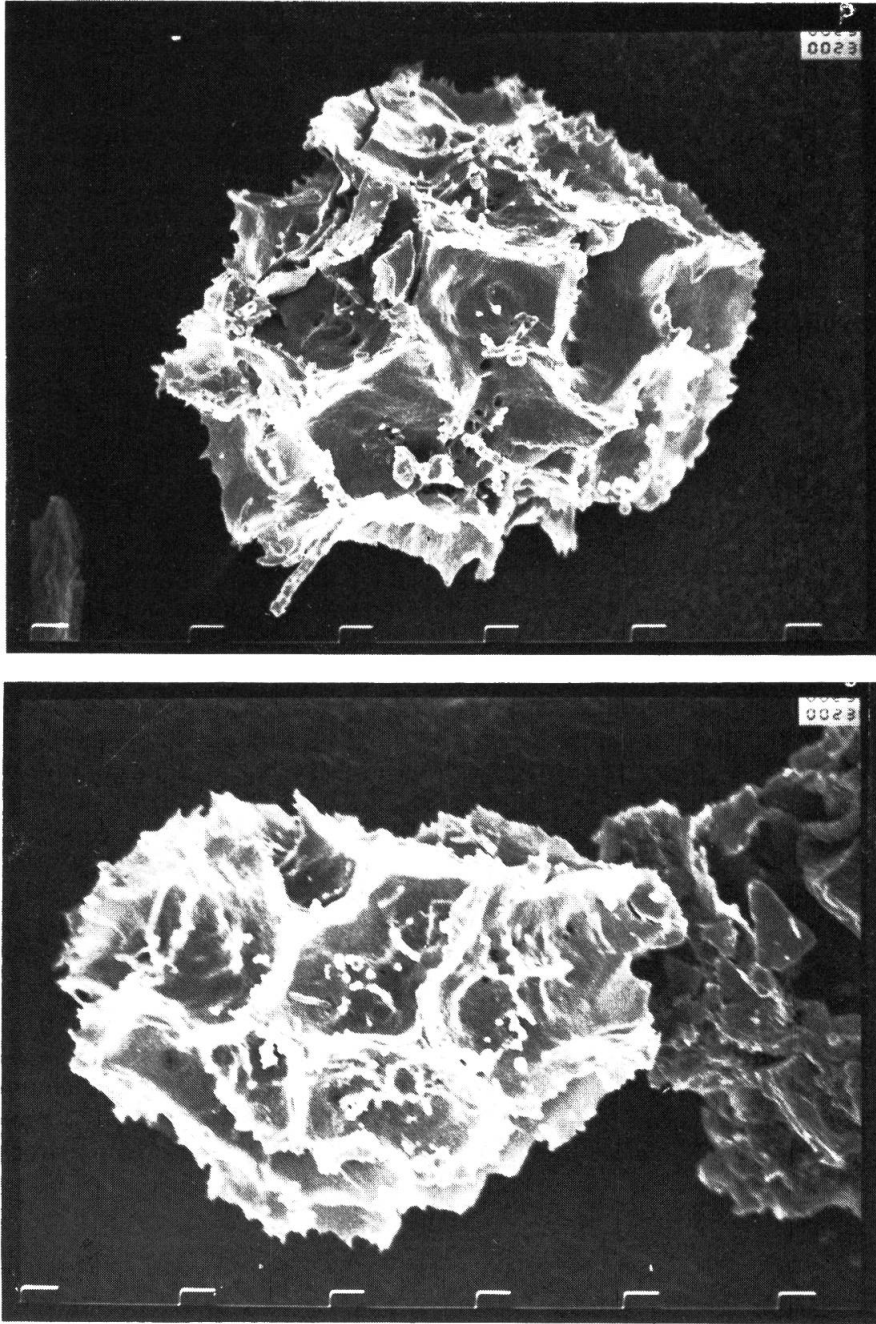


Fig. 6. — SEM photographs of two spores from the lectotype of *Asplenium varians*. Magnification ca. 1500 \times . By courtesy of P. Edwards & Dr. B. S. Parris, Kew.

The distinguishing features of *A. varians* and *A. tenuicaule* are not detailed here, as illustrations and full descriptions in English will be published by Rasbach & Reichstein (in preparation). Viane (in preparation) will additionally give a key for their separation on the basis of micro-characters. Hitherto comparative descriptions of *A. tenuicaule* (under *A. subvarians*) and *A. varians* have only been available in rare works published in Chinese: good characters for the differentiation of these two species were published by Ching & al. in *Flora Tsinlingensis* (1974: 121-123 with figures); the key to *Asplenium* in *Flora Xizangica* (1983: 177 and 183-184) also separates these two species.

7. Further elucidation of the *Asplenium varians* complex

We were at first inclined, despite small but constant differences in morphology, to treat as *A. tenuicaule* diploid plants having the same spore size as *A. tenuicaule* which occur in the central and north-western Himalayas (the latter including north-western India and Pakistan). However, several pressed specimens of the Indian diploid sent to Professor R. C. Ching were not accepted as *A. subvarians* (pers. comm., 13.6.1979). Material was also sent to R. Viane for examination with particular reference to micro-characters and his results suggest that this diploid from the north-western Himalayas is indeed sufficiently distinct to merit separation from *A. tenuicaule*. It will be described as a new species in the near future (publication in preparation).

The establishment in cultivation of living material of the *A. varians* complex from various geographical areas has already enabled us to separate some entities such as *A. tenuicaule* and the as yet unnamed Himalayan diploid discussed above. The South African tetraploid mentioned in Section 5 (p. 684) has already been distinguished by other workers. Other separable entities had not been recognized as distinct but had been identified, and even illustrated, as *A. varians*. For example, a very distinctive diploid from southern India and Ceylon is figured in BEDDOME (1864: Plate 129). Another illustration of '*A. varians*' (HOPE, 1901: Tabula XX, or reprint, c. 1970: facing p. 138) depicts as hybrid. The original plant on which this illustration is based is preserved in herb. B. M., and the details are as follows: 'C. W. Hope s.n. Sept. 1882. 7000 ft. alt. Murree' (now in Pakistan). Further discussion of this hybrid and its probable parentage will be published later.

Experimental hybridization work is now also aiding the gradual disentanglement of the mass of heterogeneous material that has in the past been classified under the name of *Asplenium varians*, and relationships between some of the species comprising the complex are beginning to be worked out. We have already indicated that some new species belonging to this complex will be described in the near future (Rasbach & Reichstein and Viane & Reichstein, both in preparation). Some of these as yet undescribed species have been found to grow in parts of Pakistan (Gilgit; Hazara) adjacent to the districts of Chitral, Dir and Swat, which, as mentioned under Section 3 (p. 681), fall within the area covered by the *Flora Iranica*. Although we found no herbarium material identical with the type specimen of *A. varians* from that area, it is possible that some of our new species may yet be found there in isolated, very mountainous parts (see STEWART, 1972: Introduction) which even today remain difficult of access.

8. The problem of *Asplenium laciniatum* Don (1825: 6)

Any discussion of the typification of *Asplenium varians* would be incomplete without a consideration of *A. laciniatum* Don. This species was described by DON in 1825, also from a specimen collected in Nepal, and the type is preserved in BM. C. V. MORTON, in his discussion of fern types (1973: 224-225), reports that he found in the British Museum (N.H.) a sheet bearing many different samples including (centre bottom) material of *A. laciniatum* Don which must be the type. In his opinion this specimen is identical with the fern described as *A. varians* by Hooker & Greville and not with the plants currently (i.e. in 1973) classified as *A. laciniatum* Don. This latter name has been mistakenly applied, following Hooker, to a large Himalayan fern allied to *A. planicaule* Wallich and agreeing neither with Don's description nor his specimen of *A. laciniatum*. Morton concludes that the application of the name *A. laciniatum* Don has to be changed, an alteration which would result in *A. varians* Wall. ex Hook. & Grev. being placed in synonymy under the earlier name of *A. laciniatum* Don. Although we agree that the plants currently classified as *A. laciniatum* Don in herbaria and floras have to be renamed, there is, in our opinion, a major objection to the replacement of the name *A. varians* Wall. ex Hook. & Grev. by *A. laciniatum* Don.

When visiting the herbarium of the British Museum in October, 1978, T. R. saw and photographed the sheet mentioned by Morton (see Fig. 7). At that time it was still in the same condition as when studied by Morton. The sheet bore material of *A. laciniatum* (pinned at the centre bottom) but there were not four specimens labelled 'laciniatum' (as Morton erroneously stated); there was but a single frond, annotated in Don's hand: '*Asplenium laciniatum* in Nepalia alpibus'. An unknown hand had added 'D. Don. Prod. Fl. Nep.' (see Figs. 7 and 8). This specimen, together with the paper to which it was affixed, has recently been removed from the mixed sheet,



Fig. 7. — Sheet in BM in the same state as at the time of Morton's examination (see text). It bears at the centre bottom the type specimen of *A. laciniatum* Don (see Fig. 8).

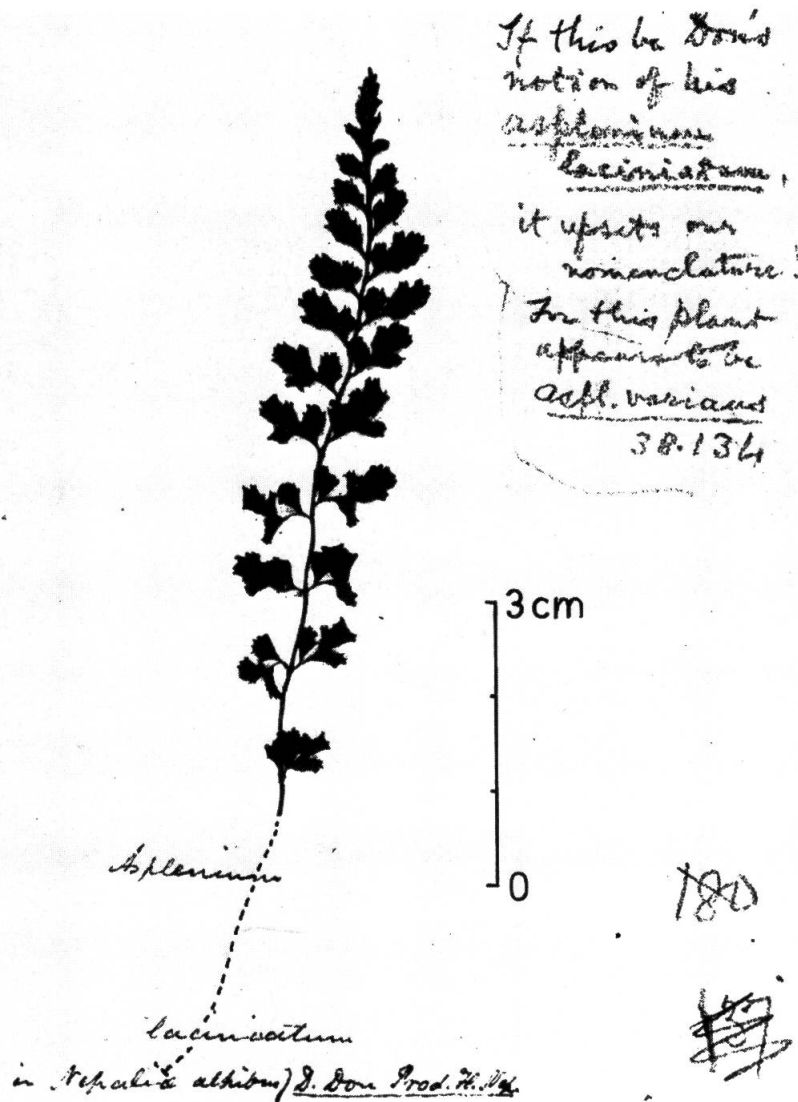


Fig. 8. — Type specimen of *A. laciniatum* Don (recently transferred to a special folder at BM). The writing in pencil is (according to C. R. Fraser-Jenkins, pers. comm., 25.6.1981) by Anthony Gepp (1862-1953), who was curator of ferns at the BM and wrote on many of the sheets. It reads as follows: 'If this be Don's notion of his *Asplenium laciniatum*, it upsets our nomenclature! For this plant appears to be *Aspl. varians* 38 134.' The dotted line gives the part of the stipe which is covered by Don's label.

remounted and placed in a new type folder. We have re-examined this frond and conclude that this specimen most probably represents the holotype of *A. laciniatum* Don, and that it is undoubtedly a member of the *Asplenium varians* complex. However, there is insufficient evidence to demonstrate the identity of *A. laciniatum* Don with the type specimen of *A. varians*. Don's specimen is a rather depauperate single frond with few spores and without rhizome scales for comparative study; therefore little in the way of morphological evidence can be derived from the frond itself. Furthermore, since it is glued on its mounting paper, not even the epidermal structure can be examined. Spore examination showed that most of the sporangia had dehisced and that very few spores were present. Spore measurements were equivocal, falling in between the ranges of diploid and tetraploid. The figures obtained suggest that Don's specimen could be tetraploid, but we cannot be sure about this. There is also some doubt about the provenance of the spores observed: they may not all belong to the frond of *A. laciniatum*. This was mounted for many years on a mixed sheet; the spores could well have come from one of the neighbouring specimens. It is impossible to draw a conclusion regarding ploidy from this limited and dubious spore sample. In view of the fact that we are unable positively to equate the type specimen of *A. laciniatum* with the type material of *A. varians* we recommend that the name *A. laciniatum* Don should be rejected and *A. varians* Wall. ex Hook. & Grev. be retained.

ACKNOWLEDGEMENTS

We are indebted to many persons, but especially to Professor R. C. Ching (Peking, China) for his advice, information, pressed plants, rare literature and encouragement; we also wish to thank Mr. C. R. Fraser-Jenkins (Oxford, England) and Dr. S. P. Khullar (Chandigarh, India) for pressed plants (some of S. P. K. of checked cytology) of the *A. varians* complex from India and Pakistan with viable spores; Professor K. Mitsui (Niigata, Japan) and Professor S. Serizawa (Aichi, Japan) for pressed plants with viable spores of *A. tenuicaule* from Japan; Dr. C. M. Kuo (working at the time in Zurich), for a photograph of the type specimen of *A. tenuicaule*, fresh pressed plants with ripe spores from the type locality in Taiwan and translations of Chinese descriptions and the key from *Flora Xizangica*; Mr. H. M. Burdet (of G) and Dr. B. S. Parris [Croxall] of K, for their help in our efforts to trace the history of the type specimen of *A. varians* and to identify handwriting; Professors R. E. Holttum (K), K. U. Kramer (Z) and I. Manton (LDS), as well as A. Henderson and I. S. Moxon, for valuable discussions and comments on the manuscript; the Director of Kew for granting one of us (A. S.) permission to measure the spores of the type specimen of *A. varians*, and for providing a new photograph of this specimen with permission to publish it, and the directors and keepers of the herbaria in B, BM, Br, CAL, DD, E, FI, K, M. MICH, P, PAN, RAW, T, W, Z for either loaning or letting us examine specimens of the *A. varians* complex.

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