Taxonomic Studies of Pteridophyta X

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岩槻邦男：シダ植物の分類学的研究 X

13. Asplenium sect. Hymenasplenium

There is no widely accepted system for the Aspleniaceae in spite of the comprehensive contributions ever made to elucidate the classification of Asplenium and allied genera. More than 700 species are currently belonged to Asplenium, although some of them are variously segregated in generic or subgeneric rank by various authors. Hymenasplenium is an example of such 'genera' and was described by HAYATA (1927) briefly in Japanese on the basis of A. unilaterale. At that time, HAYATA was much influenced by the stelar morphology of the fern rhizome and described a series of 'genera' based solely upon this feature such as Diploblechnum, Monachosorella, Boniniella, Pentarhizidium and Hymenasplenium. He was affected by his own dictum that there was no single system of plants and all the species could be classified in various ways with the definition by various discriminative characteristics. By this idea which he called dynamic classification, he denied having a fixed system in the plant kingdom, and proposed many new 'genera' based on a difference in a single feature such as stelar morphology.

The stelar morphology of A. unilaterale and its allied species was studied by IWATSUKI and KATO (1975), who concluded that the dorsiventral construction of the rhizome stel of this group evolved from a radial dictyostele typical for Asplenium by the elongation of the rhizome, probably adapted to a petrophytic habitat and it was improbable to separate Hymenasplenium generically based solely on this feature.

In this part of this series, several taxonomic features of A. unilaterale and its allied species are observed and a short revision will be given for the Old World species allied to A. unilaterale. It needs more observations on the other species of Asplenium before having the conclusive remarks on the systematic status of Hymenasplenium, but the species close to A. unilaterale are here tentatively belonged to Hymenasplenium in a rank of section among the genus Asplenium. The status of this taxon will be elucidated by more detailed comparative studies of the genus Asplenium in general.

Following HAYATA, Japanese botanists referred the species close to A. unilaterale to

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Hymenasplenium, e.g. *H. rahaense* (Hayata) H. Ito ex Tuyama, *H. cheilosorum* (Kunze) Tagawa, *H. obscurum* (Blume) Tagawa and *H. obscurum* var. angustum (Tagawa) Tagawa. These species were belonged to *Hymenasplenium* without any special comments on the 'generic' identity of the nominal taxon, and probably based on the putative alliance of those species drawn from various taxonomic features. Subdividing the genus *Asplenium* in his comprehensive Ferns of Malaya, Holttum (1955) recognized a group of *A. unilaterale* also comprising *A. normale*, *A. cheilosorum*, *A. excisum* and *A. subnormale* in addition to *A. unilaterale*, mainly based on such features as the creeping rhizome, hardly thickened or raised midribs and spore morphology.

**Taxonomic features and circumscription of the group**

It will be fruitful to observe several taxonomically important features of the species concerned before delimiting *Hymenasplenium*. The species treated were *A. unilaterale*, *A. excisum*, *A. subnormale*, *A. obscurum*, *A. cheilosorum* and *A. normale*. Several other species of *Asplenium* were observed when the comparison seemed to be necessary, especially for some features of *A. trichomanes*, *A. tripteropus*, *A. oligophlebium*, *A. tenerum* and *A. obtusifolium*.

Rhizome—The rhizome is long creeping and dorsiventral for all species in question except *A. normale*. A dorsiventral rhizome is also known in some other species of *Asplenium*, e.g. *A. cardiophyllum* including *A. ikenoi*, and *A. obtusifolium* and the species allied to the latter. The stelar structure was observed rather minutely and was concluded to have no particular feature as to indicate the generic identity solely depending upon this, for the evolution of the secondarily derived dorsiventral rhizome seems to have occurred in various phyletic courses in parallel to each other (Iwatsuki & Kato 1975). However, it should be noted here that all the species referred to the allies of *A. unilaterale* have a dorsiventral structure of rhizome stele in various degrees except for *A. normale*.

The leaves of *A. unilaterale* fall off in age remaining short outgrowths on rhizome, the structure often called phyllopodia (Fig. 25). The stipes are polished purple and hard at surface but the rhizome is green and fleshy. The phyllopodia are 2–4 mm in height and have the same appearance as the rhizome. At the junction between the phyllopodia and the base of stipes, the leaves fall off giving the alternate scars on rhizome as the phyllopodia. The same construction, differing in size, is observed in *A. excisum*,

![Fig. 25. Phyllopodium of *A. unilaterale*, natural size. Left, on young rhizome; central, of matured leaf; right, on old rhizome after the leaf fallen off.](image-url)
A. subnormale and A. obscurum. In A. cheilosorum the stipe base is swollen to some extent but no distinct phyllopodium is observed. I have seen no living materials of A. obtusifolium but the stipe base seems to be swollen in this species. In A. normale no phyllopodium is seen and the stipes are persistent even after the pinnae have fallen off.

Frond—The frond is simply pinnate and medium in size for all the species in question. This type of frond construction is most typical for Asplenium, and there is no particular taxonomic value in this feature of our species. The size and form of pinnae are variable according to the species. The pinnae of A. normale are deciduous, often completely falling off in age to have many naked rachises on one stock giving an appearance of the spines of a sea urchin. The pinnae are persistent for all the other species concerned, whereas deciduous pinnae are characteristic of such species as A. trichomanes, A. tripteropus and A. oligophlebia among the species of Asplenium comparable to A. normale.

The rachis of A. normale is mostly gemmiferous, and in this character this species is different from the other species of Hymenasplenium but common with the species enumerated above. A gemmiferous habit is observed in various species of Asplenium and seems to have been derived in parallel along various evolutionary courses. Yet, it will be noted here that this feature is wholly absent in the species referred to the group of A. unilaterale but is observed in A. normale and the species allied to A. trichomanes.

Venation—In all the species now under consideration, the lateral pinnae are dimidiate in various degrees, or the posterior half of the basiscopic side of the lateral pinnae is absent (Fig. 26). This is not rare in Asplenium but we can observe the special venation for the species belonging to Hymenasplenium except for A. normale. In those species, the absence of posterior basiscopic portion is so distinct that veins are found on the basiscopic side only after 2 to 4 acrosopic veins are given off. The same type of venation is found among Asplenium species such as A. laetum. In A. normale the basalmost basiscopic veins are given off after one or two acrosopic veins are seen, and the species allied to A. trichomanes is similar to A. normale. In A. obtusifolium the lateral pinnae seem to be dimidiate but no deficiency is observed on the basiscopic veins, the veins of this species

![Fig. 26. A pinna with details of venation, all x 2/3. a, A. unilaterale, Tagawa & Iwatsuki 537; b, A. exiosum, Iwatsuki 5043; c, A. subnormale, Price 664; d, A. obscurum, Tagawa 2063; e, A. cheilosorum, Iwatsuki 3428.](image)

![Fig. 27. Raphide of A. unilaterale var. udum, surface view of bleached lamina, x 400.](image)
being arranged alternately.

This type of venation is more typical in *Lindsaea* and no particular systematic value has been given to this feature even in this genus. In our case it will only be pointed out that the deficiency of the posterior basiscopic veins is distinct for *A. unilaterale* and close allies.

Crystals—In parenchymatous cells there are observed a mass of crystals (Fig. 27). They are raphides, probably of calcium oxalate, insoluble in dilute hydrochloride solution. This kind of raphide is observed in all the individuals examined of *A. unilaterale*, *A. obscurum*, *A. subnormale*, and *A. excisum*, but not in *A. cheilosorum*, *A. normale* nor *A. oligophlebium*. It is interesting that the same kind of raphide is observed also in *A. obtusifolium*.

POIRAULT (1893) noted that small crystals were commonly observed in various species of ferns, but the occurrence of such crystals is generally not so common as in the flowering plants (Ogura 1972). *A. decorum*, under the name *A. belangeri*, was described to have small crystals, and this is true also for *A. tenerum*, a relative of the former species, though they have no crystals in the form of raphide.

Cytology—Among the species now under consideration, *A. unilaterale*, *A. cheilosorum* and *A. normale* have been examined cytologically. MEHRA & BIR (1960) made a detailed observation on *A. cheilosorum* and elucidated that this is an apogamous species. I have examined the Japanese materials and found that each sporangium contains only 32 spores. *A. normale* was reported as tetraploid for Indian and Ceylon plants but diploid for Malayan plants, both with normal life cycle. Morphology of the gametophytes of *A. normale* was described by Momose (1959). *A. unilaterale* was studied cytologically by several authors, but the results were various. From the observation of the gametophytic morphology, Momose (1960) elucidated this as an apogamous species, and this observation was cytologically proved by Kurita (1960) for Japanese materials. I have collected a great number of gametophytes in Kii-Tonda, Japan, but no sexual organ could be observed in any of these prothallia. Outside Japan, however, there are records of various chromosome numbers for this species: n = 40 and 76 for Indian plants and n = 80 for the Ceylon materials. Examining a number of herbarium specimens, I found that this polymorphic species includes both apogamous plants and those with a normal life cycle. The variation of the species by this difference in life cycle will be treated in a separate paper. According to the spores counted in each sporangium, all the other species of this group seem to have normal life cycle, i.e. *A. excisum*, *A. obscurum* and *A. subnormale*.

Palynology—HOLTTUM (1955) evaluated the spore morphology to define his group of *A. unilaterale* including *A. normale*, citing ‘the spores...dark, with wide thin transparent wing, its edges uneven and often toothed, with anastomosing folds (sometimes many) all over the surface of the spores’. His observation is confirmed by observing the spores of all the species in question (Fig. 28). On the surface of the spores observed are the spinules with pointed apex rather densely in *A. obscurum* and *A. subnormale* and less so in *A. excisum*
Fig. 28. Spores, all ×800. a, A. subnormale, Price 664; b, A. excisum, Tagawa 2766; c, A. obscurum, Tagawa 2099; d, A. cheilosorum, Iwatsuki 3347; e, A. normale, Tagawa 7676; f, A. obtusifolium, H. H. Smith 1126.

and A. unilaterale. The spinules are smaller and less pointed at apex in A. cheilosorum. The spinules of A. normale, A. oligophlebium and A. tripteropus are warty with round apex, and such warts are smaller and very sparse and often nearly smooth on the surface in A. trichomanes. A warty surface of the spores is also observed in the species allied to A. tenerum. The difference between spinose and warty surface of the spores seems, however, to indicate insufficiently the remoteness of the species, for it is known that the Himalayan type of A. phyllitidis is quite distinct in spore characters from the Malesian form of this species even in the case where these two forms can be recognized as two subspecies (Holtum 1974).

I have insufficient materials of A. obtusifolium for palynology, but the spores of this species are different from those of Hymenasplenium in having no transparent wing over the surface, paler coloration, and the surface densely covered with round and small warts.

Gametophytes—There are observations made by Momose (1959, 1960) for A. normale and A. unilaterale as noted above. The other species are not observed for the gametophytic generation.

Comments on A. normale—Asplenium normale has a wide range of distribution in tropical and subtropical areas throughout the Old World, from East Africa, tropical Asia north to the Himalayas and Japan, and Polynesia north to Hawaii. As this is somewhat variable in various features, several names have been given in infraspecific level, but it is rather difficult at present to fix the taxonomic status of this species. There are several features common to this species and the others included in Hymenasplenium, but we can enumerate the features unique to A. normale when we place this in the nominal taxon,
i.e. rhizome short, ascending to suberect, typically radially dictyostelic in construction, bearing stipes clustered on the apical portion of rhizome; stipes persistent on the rhizome forming no distinct phyllopodium at the base; rachis more or less distinctly grooved with ridges; lateral pinnae sessile, imbricate, spreading, apex round to subtruncate, base truncate and slightly auricled at acrosopic side, very narrowly cuneate at basiscopic side, the anterior margin as well as apex evenly toothed, to 2.5 cm long, one or two posterior basiscopic veins often absent; rachis often remaining as a rod falling off all the lateral pinnae, usually gemmiferous at or near the apex; spores warty on surface. *A. oligophlebium* and *A. tripteropus* in the Far East are similar to *A. normale* in most of the features cited above, and it is possible to refer tentatively all the three species to the allies of *A. trichomanes*, although it is better kept unfixed until all the species of *Asplenium* will be compared minutely and the subdivision of this large genus will be made on a sound basis.

Comments on *A. obtusifolium*—This species is known in tropical America and common with *Hymenasplenium* in the Old World in having long creeping rhizome with dorsiventral stelar construction (METTENIUS 1864) as well as the occurrence of fine needle-form crystals (GIESENHAGEN 1892), but this species is distinct from *Hymenasplenium* in spore characters and others. The swollen base of the stipe is similar to that of *A. cheilosorum* but no typical phyllopodium is found in the species. The posterior half of the pinnae is little cut off in basiscopic side giving off the same number of veins as the acrosopic side. I have examined only a few number of the herbarium specimens of this species and have no conclusive remarks at present concerning the relationship of this species and *Hymenasplenium* in the Old World. It is interesting to give here a short comment about the occurrence of var. *aquaticum* in Venezuela in very wet places. The plant of this variety has been reported to have thin laminae with only three layers of cells and usually lacking the intercellular space and stomata (GIESENHAGEN 1892). This is comparable to *A. unilaterale* var. *udum* which will be treated in detail in the further pages.

Excluding *A. normale* as stated above, *Hymenasplenium* will be circumscribed as a subgroup of *Asplenium* in the Old World and diagnosed as follows.

**Asplenium** sect. **Hymenasplenium** (HAYATA) K. IWATS. stat. nov.—*Hymenasplenium* HAYATA, Bot. Mag. Tokyo 41: 712. 1927, type: *A. unilaterale* LAMK.

Rhizome creeping, with two alternate rows of stipes on upper surface, scaly in younger portion, green to dark stramineous; internal structure of rhizome dorsiventral in construction (probably derived from a radial dictyostele) with a larger ventral strand and a thinner dorsal strand, root traces on ventral and connecting strands, and on dorsal strand as well in some species; stipes terete, scaly at base, glabrescent upwards, dark purplish-brown to dull grey-green, fallen off in age remaining the scars as short outgrowths of the rhizome or phyllopodia which are not so distinct in *A. cheilosorum* whose stipe bases are
swollen to some extent; rachis not or very shallowly grooved without any distinct edges, usually with wings, seemingly grooved in dried specimens, not producing any gemmae; lateral pinnae more or less stalked, persistent, the acrosopic base cuneate to subtruncate, the basiscopic base excised, or the margin of pinnae close to the costa for a quarter to a half of the length of pinnae, one to four posterior basiscopic veins absent, margin except for the excised part toothed or incised, usually more than 3.5 cm long, or about 2.5 cm in *A. subnormale* and *A. unilaterale var. udum*; laminar tissues two to several layers thick, the intercellular spaces ill developed; reproduction normal, or apogamous in *A. cheilosorum* and some individuals of *A. unilaterale* in which no sexual organs were found in the gametophyte.

Thus confined as a section of *Asplenium*, five species* and a variety belong to *Hymenasplenium* in the Old World. The species treated here will be distinguished as in the following key, although most of them are difficult to distinguish with a few words. A more detailed discussion will be given in the pages of each species.

A  Pinnae toothed on acrosopic side; sori often more than 3 mm long (usually to 3 mm in *A. obscurum*), not confined to the lobes but on middle or basal part of the veins or below the bottom of sinus; stipe base a more or less distinct phyllopodium.

B  Stipe and rachis dark purplish-brown, more or less polished; sori commonly longer than 3 mm.

C  Fronds larger, usually more than 15 cm excluding stipes; stipes dark purplish-brown, polished; pinnae commonly more than 15 pairs, usually 20–25, the ratio between length and breadth of pinnae 3–4 : 1.

D  Fronds to 9 cm wide, oblong in outline; the largest pinnae (2.2–) 2.5–3.5 (–5) cm long.............................................................*A. unilaterale*.

E  Pinnae patent to ascending; lamina several cells thick, with stomata on lower surface, soft herbaceous in texture...........................................*var. unilaterale*.

E  Pinnae very obliquely placed; lamina two cells thick without intercellular space, stomata none or few, transparent, membranous................

.............................................................*var. udum*.

D  Fronds to 18 cm wide, widened towards base; the largest pinnae (4.5–) 7–9 (–12) cm long .........................................................*A. excisum*

C  Fronds smaller, to 12 cm long excluding stipes; stipes purplish to brownish, obscurely polished; pinnae to 10 pairs, the ratio between length and

* As noted in the further pages, both *A. excisum* and *A. subnormale* might better be ranked as the varieties of *A. unilaterale*, though they are enumerated here in the rank of species in comparison with *var. udum* and to avoid creating an additional combination of name. It is the matter of choice by the authors whether they are ranked in species or variety, and I prefer to retain them in specific rank admitting that they are very close to *A. unilaterale*, a variable species including the intermediate forms between this and the two species in question.
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Breadth of pinnae 2–2.5 : 1 .................................A. subnormale

B Stipe and rachis dull grey-green, not polished; sori short, usually to 3 mm long, allantoidioid .................................A. obscurum.

A Pinnae incised on acrosopic side; sori shorter, to 2 mm long, confined to the lobes; stipe base swollen, phyllopodium not developed .................................A. cheilosorum.


*Asplenium laetum* Wall. List n. 290. 1828, n.n.


Asplenium cataractarum Rosenst. Hedwigia 56: 334. 1915, type: Taiwan, Faurie s.n. (Isotype in TI !)

var. unilaterale.

Distribution. Tropical Africa to Madagascar, Mascarene, Seychelles, Ceylon, S. India, Himalaya, China including Taiwan, Burma, Thailand, Indochina, northwards to S. Japan through the Ryukyus, Malaysia east to New Guinea, and Polynesia north to Hawaii.

Ecology. Commonly petrophytic in stream-bed or on cliffs in constant spray, or on wet sandy ground along streamlets, usually in deep shade or half-shaded places.

As shown in the long synonymy given above, it will be understood easily that this is quite a variable species. The variation in cytology, including the apogamous plants and various chromosome numbers, will stand as an evidence of the variation within the species. The variation can not be analysed in details in the present study and needs the comparative studies throughout its wide distribution area.


Asplenium resectum var. decurrens Bedd. Suppl. Ferns 10. f. 357. 1876, type: N. India. —Asplenium decurrens WALL. List n. 190. 1828, n.n.


This variety is distinguished from var. unilaterale by having thinner and subtransparent laminae, obliquely placed pinnae and usually smaller size of plants. As summarized in the above synonymy, this form has variously been distinguished from the typical form of A. unilaterale, though this seems to be a form adapted to a particular subaquatic habitat in very wet place under constant spray. The laminar tissue is quite simple, composed of only two layers of cells as shown in Fig. 29. As the result of such a distinct simplification, no intercellular space is observed, and the epidermal tissue is quite

* Both of these two types were cited in Hayata's original report as collected by Hayata & Sasaki, though on the herbarium sheets in TI we found only the name of Hayata as the collector.
different from that of var. unilaterale. Kurata (1962) notes that the blade of A. obliquissimum (Hayata) Sugimoto & Kurata is composed of one cell-layer, although I have seen no materials with unistratose laminae. The type of A. unilaterale var. obliquissimum has bistratose laminae.

The epidermal cells are usually rectangular in outline in surface view and stomata are not or hardly observed on the lower surface (Fig. 30). In some plants no stomata are found on the lower surface of the pinnae throughout or in the others the stomata are observed in less frequency than in var. unilaterale, at most a stoma for more than 10 regular epidermal cells. Moreover, it will further be noted that the incomplete stomata with only the auxiliary cells but without any guard cells are often observed. Comparing with the case of var. udum, commoner morphology is observed for the epider-

Fig. 29. Transection of lamina of A. unilaterale. Upper, var. unilaterale, × 400; lower, var. udum, × 300.

Fig. 30. Epidermis and stomata of A. unilaterale. Upper left, var. unilaterale, surface view of epidermis; upper right, transection of stomata of var. udum; lower, var. udum, surface view of epidermis, note an incomplete stoma in the right.
mal tissue of var. unilaterale: the lamina consists of more than 4-6 layers of cells with intercellular spaces; each epidermal cell forms a sinuous outline in surface view; and the stomata are observed as usual in the common fern leaves (Fig. 30, upper left).

The specialization of the epidermal tissue seems to be independent of the influence of the habitat specificity; plants in very wet or subaquatic places may have laminae with stomata, and on the contrary the plants without any stomata are found in not so wet place, or moist but exposed place without any constant spray. Mr. S. Mitsuta of our laboratory has kindly collected this variety on the island of Yakushima carefully in three different habitats: 1) in very wet place with permanent spray; 2) on moist rock without spray, and 3) on muddy cliff partially exposed to the sun. All the materials are with bistratose laminae and the stomata are rarely observed. The occurrence of stomata does not necessarily depend on the habitat, and is: a few for 1), none for 2) and very few for 3).

This form of Aspleniun unilaterale is known in N. India and Nepal, Tonkin, S. Japan, Kweichow* and Taiwan, Philippines, Borneo, and Java. There are forms similar to var. udum in appearance from other localities, but I could not find any referable to this with bistratose laminae. The New Guinean materials identified as Aspleniun filipes by Copeland are var. unilaterale with more than four layers of laminar cells and numerous stomata on the lamina underneath. Aspleniun unilaterale as a whole is variable, and it is not advisable to consider the local forms in the same pattern as to be the derivatives independent of each other. This form is safely treated as a special off-shoot of Aspleniun unilaterale in subaquatic habitat: a parallel phenomenon was observed by GiesenHagen (1892) on Aspleniun obtusifolium in the American tropics as noted on the previous pages.


* Ching (1965) records this variety from five other provinces in China, but I have not seen the specimens actually.

** One of the two syntypes of Aspleniun resectum var. rahaoense Hayata and a single specimen cited in Aspleniun rahaoense Yabe ex Matsum. & Hayata, Enum. Pl. Formos. 605. 1906, n.n.

NII-Electronic Library Service
Asplenium obscurnum auct. non Blume; Ogata, Ic. Fil. Jap. 5: pl. 208. 1933.

Sledge (1965) ranked this as a variety of A. unilaterale with a detailed discussion about the variation in size. As the latter is quite variable as noted above, it is rather difficult to describe by short diagnostic sentence the difference between A. excisum and A. unilaterale, though there are few materials which are difficult to be identified as one of them.

The difference in size is one of the most convenient indicators to distinguish them. The length of the largest pinnae within one individual ranges (4.5–) 7–9 (–12) cm in A. excisum and (2.2–) 2.5–3.5 (–5) cm in A. unilaterale. The largest size of pinnae of A. excisum observed is 12 cm in length (Tagawa 1981 from Taiwan) and 2.2 cm in breadth (Ohwi 378 from Taiwan). Even in the plants with the pinnae of intermediate size, it is easy to give an identification with the help of a combination of other characters which are variable to some extent and each of which is not useful as the key character. 1) The root traces are found on the dorsal side of the rhizome in addition to the ventral side in A. excisum and this is true in the anatomical observation, too (Iwatsuki & Kato 1975). We have made anatomical observations on the variation of the rhizome according to the size of A. unilaterale and found no root traces on the dorsal strand of the latter species. 2) The basal pinnae are usually the longest and or a little deflexed in A. excisum, but are not the longest and hardly deflexed in A. unilaterale. The outline of the lamina is lanceolate in the latter and elongate subtriangular to oblong lanceolate in the former species. 3) The lateral pinnae are usually widely placed, nearly to rectangular, in A. excisum, while they form a narrower angle to rachis in A. unilaterale, and the pinnae are more ascending in var. udum of the latter species. 4) The lateral pinnae are more or less dimidiate, or the posterior half is cut off in the basiscopic side for both the species in question. In A. excisum the posterior basiscopic lamina is wholly absent, or the posterior portion of costa bears no lamina on the basiscopic side, and then the laminar surface appears along the line of veinlet which is rather widely placed with costa at an angle of 40–50°; while in A. unilaterale the posterior basiscopic laminae are reduced but usually still present and the veinlet is with very acute angle to costa, usually 10–30°. As noted above, these features are variable in both the species, and intermediates are present in each feature, but when all these features are taken into account, it is possible to separate these two species. In general A. excisum is found terrestrial on humus rich ground in deep forest, while A. unilaterale is commonly petrophytic in very wet place in shade.

The first published name of this taxon at varietal rank is A. resectum var. rahaoense, and Sledge’s name is superfluous according to the rule if the Taiwan plants are identical with f. majus C. Chr. as identified here.

This species is widely distributed in the tropics throughout the Old World. It is not clear at present whether the larger size of this species is corelated with the terrestrial growth form or not.


Extending the area of this species as noted above, the species is more variable and becomes rather difficult to distinguish from *A. unilaterale* by definition. This is different from *A. unilaterale* by the combination of such characters as: rhizome not so long creeping, bearing roots on all surfaces, internal root traces on dorsal strand as well; stipes rather close to each other, usually less than 1 cm apart from the next one, castaneous to purplish, more or less polished; fronds oblong with attenuate apex, 3–10 (–15) cm long, to 4.5 (or rarely to 7) cm wide; lowest pinnae shorter and wider, subdeltoid in outline; lateral pinnae proportionately wider, commonly 1–2.5 cm long, 0.5–1 cm wide, round to very moderately acute at apex; texture herbaceous, dull green.

There are several collections from Samar and all of them are identified as *A. subnormale* by *Copeland* on the herbarium sheet, although this island is not included in the area of this species in *Copeland's* Flora (1960). The Samar plants are smaller, up to 15 cm long including the stipes, to 3 cm wide, or commonly about 10 cm long, 2 cm wide; the lowest pinnae a little reduced; pinnae rather sharply incised at margin, subquadrangular in outline, obtuse to moderately acute at apex, with more or less distinct stalks; texture papyraceous. Sabah collections are similar in some respects to this and are intermediate between Samar and typical forms. Contrary to this form, the Sarawak collection and the Batan Island specimen are intermediate between *A. subnormale* and *A. unilaterale* in general habit, though they are identified here as the former species. The specimens from the island of Yonaguni, the westernmost island of the Ryukyus and some 450 km north of Batan island, are proportionately still longer, 8–13 cm long, to 6 cm wide, and more similar to *A. unilaterale*. They were collected at the foot of cliffs or on dry forest floor, and are different from the Philippine materials which are petrophytic in stream beds. *Miyake s.n.* from Kotosho (Botal Tobago) is typical form of this species. In TI there is another specimen identified to this species, but the information available is only from Taiwan, no further details of locality nor collector's name and date of collection. I have not seen

* Herbarium of the University of Ryukyu, Naha.
the specimens from Pulau Tioman on which Holtum (1955) draw a detailed description.


Asplenium cristatum Wall. ex Clarke, Trans. Linn. Soc. II. Bot. 1: 481. 1880, non Lamk. 1786.


Distribution. E. Africa, Madagascar, Ceylon, S. & N. India, S. China to Taiwan, Burma, Thailand, Indochina, and Java.

Habitat. On wet rocks or on wet sandy ground in dense moist evergreen forest usually along streamlets.

This is similar to *A. excisum* in appearance but is distinct from the latter in: rhizome short creeping, bearing the stipes rather closely; stipes pale green to stramineous, or rarely castaneous, but never purplish nor polished; lateral pinnae more or less ascending, subquadrangular in outline with rounded to moderately acute apex, (3–) 3.5–5 (–7) cm long in the longest ones within individuals; sori short, usually less than 3 mm long, mostly allantodioid. Smaller plants approach *A. subnormale* in gross aspect but differ from it in the coloration of stipes and rachis, papyraceous to soft papyraceous texture of laminae in green colour, and not so small as the latter species.


HABITAT. Petrophytic on wet cliffs usually in the path of continuous spray along streams in dense mountain forest.

Among the species enumerated in this paper, this is the species distinct from *A. unilaterale*. It is possible to subdivide *Hymenasplenium* of the Old World into two subgroups: one including *A. unilaterale*, *A. excisum*, *A. subnormale* and *A. obscuro* and the other consisting of the single species, *A. cheilosorum*. The latter is different from the former in such features as: rhizome not so long, stipes rather close to each other, the base of stipes more or less swollen, the phyllopodium not distinct but the stipes deciduous, lateral pinnae dimidiate, the basiscopic margin nearly straight hardly leaving the laminar surface on the basiscopic side even in the distal part, the acrosopic side distinctly incised to about 1/4-1/3 way towards costae, sori short, confined to the lobes, spores with spinules of round apex, no raphides in the laminar cells, reproduction apogamous.

**Excluded species**


It seems to belong to *A. excisum* but the type material has not been carefully examined by anyone since the time of Copeland's publication.


*Asplenium unliangshanense* Ching, l.c. 186, type: Yunnan, Hsu.

*Asplenium latdens* Ching, l.c. 187, type: Yunnan, Tsai 51583.

*Asplenium changputunganense* Ching, l.c. 188, type: Yunnan, Wang 66978.

*Asplenium quercicola* Ching, l.c. 188, type: Yunnan, Wang 72513.

*Asplenium szechuanense* Ching, l.c. 188, type: Szechuan, Chu 2487.

*Asplenium furfuraceum* Ching, l.c. 190, type: Yunnan, Ching 25478.

All of the above seven species were based on one or two specimens collected in Yunnan for six species and Szechuan for one. They were compared with *A. unilaterale* and were distinguished from the latter by various features. I have not seen any materials actually, and can only suggest here that they may not be distinct specifically, although I can not dare to cite the names in synonimic list of *A. unilaterale* until I can examine the type specimens.

**Acknowledgement**

A number of specimens were sent to Kyoto on loan from the following herbaria: Museum at Berlin-Dahlem (B), Phanerogamic Museum at Paris (P), University of Ryukyu (RYU), Singapore Botanic Garden (SING), University of California (UC) and Smithsonian Institution (US), and the specimens were examined in the University of...
Tokyo (TI). I am grateful to the directors and curators of the above herbaria. I am thankful to Mr. M. G. PRICE who helped me in affording several Philippine materials and gave me valuable suggestions to the manuscript. I owed Mr. H. MANAGO in the field work, Mr. S. MATSUDA in collecting several Japanese materials, and Mr. M. KATO in photographing process.

References


胎子の構造もチャセンジダ属にふたうもので、配偶体の構造は調べられていない。ウスパクジグクは無配生殖をすることが確められており、ホウビンダでも無配生殖をするものと正常なものがあるようである。

ネリトランノをホウビンダの仲間のものと考える人がいる。しかし、根茎が短く、斜上し、放射網状中心柱をもっており、葉柄は宿存性、それに対して羽片は早落性、中脈には無性芽をつける。針状結晶はなたない、などの性質をみると、ホウビンダの仲間とは違って、むしろカミガモンダ・イヌチャセンジダを通じてチャセンジダに近いものということになる。

新世界的 A. obtusifolium は根茎が内部構造までホウビンダと同じような背腹性を示すこと、細胞に針状結晶を含むことなどで、旧世界的ホウビンダの仲間と共通の性質をもっている。しかし、胎子の構造が違うため、葉足が形成されないこと、羽片の下剣内半分が欠けても葉脈には省略がみられること、などの点で差が認められる。この種にも近縁種が数つかあるようです。この仲間がホウビンダ類と並行に分化してきたものか、または両者の間に系統的な関係があるのか、新世界的材料についてもっと詳しい観察をしなければ結論は出せない。

ホウビンダの仲間は旧世界的ものについてはよくまとまった群を形成しており、ここでホウビンダ節と反節の階級で区別することにしたが、チャセンジダ属全体については少し詳しく研究されないと正確な階級上の位置を見極めることはいまではない。ただ、ネリトランノを含むチャセンジダの仲間は、おそらく節の階級では区別できても、たとえば亜属では同じになるというように、チャセンジダ属の他の群に比べると近い関係があるように推定される。

ホウビンダ節に5種を挙げたが、これを2群に配列することができる。ホウビンダなど4種はよく似てい、種として区別することの可否さえ問題になる位だから、ごく近縁なものの認識されるが、ウスパクジグクだけはたとえば画説に別に数えるようなものである。差を列挙すると、根茎は比較的短く、葉柄は近接してつき、葉部は膨らむが葉足は形成しない、羽片は下側がほとんど先端近くまで欠落し、上側は比較的深い鋸歯縁となって胎子囊群は裂片につく、針状結晶は含まれず、無配生殖を行なう、などである。

ホウビンダ近縁の4種というのは、ホウビンダ・ラハオシダ・ウスイロホウビンダ(新称)・ミドリラハオシダである。ホウビンダの仲間は秦仁昌が8つも新種を加え、それまでに種の階級で区別されていたヤクシマホウビンダ・オトメホウビンダを加えると相当数に達する。ホウビンダの種の構造については広い分布域全体を対象とした解析が必要であるが、今回はそこまで進めることはできなかった。ただ、この種には既に40,76,80などという染色体数が報告されていたり、無配生殖の記載もある上、予備的な検討の段階でも、正常な生殖のもと無配生殖のものがあることが確かめられており、丁寧に調べてみる必要のあることが示唆される。

ヤクシマホウビンダについては詳しく調べてきたが、この型では葉面がすべて細胞2層できており、表皮が表面観でも波状でない細胞になり、気孔が極端に少ないか完全になくなっている。生育場所はビショビショに湿れた半水生的なものであるが、そういう生活型に適応して単純化した例であるよう。同じような分化が、先述の A. obtusifolium についても知られていることは興味深い。一応変種として区別するが、母種のホウビンダについて多型であることが分かれば、それから分化してきたものも単一ではないということになるかもしれない。

ウスイロホウビンダはフィリピン・ボルネオ・マラヤの島に記録されていて、紅頭髪のものについて分布を確認し、また幾分疑いをもちながら与那国島のものもこの種だろうと判断した。