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SOME ADDITIONAL SPECIES OF HETEROGONIUM

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SUMMARY

The free-veined indusiate species of *Heterogonium* Presl and two additional exindusiate species are redescribed. Five new combinations under this generic name are made.

In the "Sarawak Museum Journal" (5: 156-166. 1949), I re-defined the genus *Heterogonium* Presl and described species then known to me. In the following year (*in Reinwardtia* 1: 27-31. 1950). I published a revised account of the genus, based on specimens in the herbarium at Bogor (Buitenzorg). Some additional specimens were later discovered when Dr. M. A. Donk and I sorted out all the specimens of *Dryopteris* (in the sense of Christensen's "Index") in the Bogor Herbarium. Among these additional specimens were two which represented species which I had overlooked in previous search of literature. Both these species agreed with *H. sagenoides* in having free veins and indusiate sori. A re-examination of *H. sagenoides* and its comparison with the two additional species then became necessary, and the results of this study are incorporated in the present paper. I have furthermore found at the British Museum two other species of *Heterogonium* not mentioned in previous papers; these also are here mentioned.

THE FREE-VEINED INDUSIATE SPECIES

In the second paper above mentioned (*in Reinwardtia* 1: 28) I mentioned the variation in hairiness among specimens of *H. sagenoides*. In re-examining these specimens, in comparison with the additional specimens found at Bogor, I have found that two distinct forms of hairiness exist, and believe that these are a reasonable basis for specific separation.

In all the free-veined indusiate specimens of *Heterogonium*, the sterile fronds are much more hairy than the fertile ones, on both surfaces. It is especially the pubescence of the upper surface which seems to me significant, and for comparative purposes sterile fronds are most useful. The costa is in all cases densely covered with multiseptate hairs, usually short, while on the surface of the lamina are some thick lax multiseptate

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hairs; these hairs are green when living, rusty brown when dry. In some specimens there are present also on the upper surface of the lamina more numerous and much smaller, slender hairs. There are also two other kinds of difference in hairiness of the upper surface of sterile fronds which seems significant.

In some specimens the hairs on the costae are as long as those on the lamina; and in some others the hairiness is reduced to a few hairs near the sinuses. When specimens are separated on these characters of hairiness, their general appearance indicates that a natural separation has been made into four species, though precise distinguishing characters based on other features of the fronds are difficult to define.

I have examined the spores of many specimens. All have a winged perispore, the wing always narrow, often crisped; in some specimens the wing is complex, with much anastomosis of parts, in some simpler in structure. I am not sure that the differences are such as to characterize the species clearly.

If we recognize four free-veined indusiate species of *Heterogonium*, this question arises: to which of the four species does the type specimen of *H. sagenoides* belong? Search at Bogor and at Leiden has failed to discover a specimen of the type collection (Java, Zollinger 1803), and I have not seen any other specimens from Java that might belong to the species. In Malaya these plants are only found in lowland forest, and it is quite possible that owing to almost complete destruction of such forest in Java, the species is now exterminated in that island.

The only source of information about the type specimen of *H. sagenoides* is therefore the original description by Mettenius. The lamina described as "supra hirta, ad costas ferrugineo-tomentella," and as 1½' (45 cm) long. These two statements together indicate the probability that the type was like the species found in Singapore island. I have therefore given the name *H. sagenoides* to this species; this procedure also is convenient, as the other three species already have other names. If the type specimen of *Aspidium sagenoides* Mett. should be located and found to be different, a further study of the present group of species will have to be made, and some further modification of names. The following key distinguishes the four species as at present known.

KEY TO THE FREE-VEINED INDUSIATE SPECIES OF HETEROGONIUM

1. Hairs scattered all over the upper surface of lamina of sterile fronds.
2. Hairs on upper surface of lamina of sterile fronds all alike.
3. Hairs on upper surface of costae of sterile fronds all much smaller than hairs on lamina, not spreading; small ferns. 1. *H. sagenoides*

3. Hairs on upper surface of costae of sterile fronds nearly as large as hairs on lamina, spreading; larger ferns. 2. *H. wiganii*
2. Hairs on upper surface of lamina of sterile fronds of two kinds, large and small. 3. *H. gurupahense*
1. Hairs on upper surface of lamina of sterile fronds confined to small groups near sinuses. 4. *H. subglabrum*

1. *HETEROCONIUM SAGENOIDES* (Mett.) Holtt. in Sarawak Mus. J. 5: 161. 1948.

Aspidium sagenoides Mett., Ueber einige Farngatt. IV in Abh. senckenb. naturf. Ges. 2: 397. 1858.

Ctenitopsis sagenoides Ching in Bull. Fan. mem. Inst., Bot. 8: 312. 1938.

Ctenitis sagenoides Copel., Gen. Fil. 124. 1947.

Sterile fronds: stipe to 35 cm long, lamina 25—40 cm long, 16—25 cm wide; pinnae about 10 pairs (rarely to 15) below the triangular lobed apical lamina; pinnae sessile, middle ones to 15 by 3 cm, base very broadly cuneate, acroscopic basal lobe longer than basisopic and close to rachis, edges lobed to about 3 mm from costa, lobes oblique, entire, about 5 mm wide, apex of pinna narrowly caudate for about 3 cm and almost entire; upper surface bearing coarse scattered multiseptate hairs 1—1.5 mm long, with much shorter hairs on costa only; lower surface bearing scattered spreading multiseptate hairs 1—1.5 mm long on the raised veins and costae only; lowest pinnae somewhat shorter than middle ones, narrower at the base, widened in the middle on the basisopic side.

Fertile fronds: stipe to 45 cm long; lamina 25—40 cm long, commonly 16 cm wide; middle pinnae to about 10 by 2 cm, shaped as sterile but lobes about 3.5 cm wide and sometimes crenate, separated by distinct sinuses not wider than the lobes, cut to within 2 mm of the costa; upper surface with much fewer and somewhat shorter hairs than on sterile fronds, lower surface glabrous or nearly so; veins mostly forked, a sorus on the shorter acroscopic branch of each vein.

SPECIMENS EXAMINED.—MALAY PENINSULA. Singapore. Bukit Timah: *Ridley s.n.*, 1894, 1908; *Hullett s.n.*, 1882; *S.F.N.10483* (Holttum). Trengganu. Kuala Berang, *S.F.N.15321* (Holttum). Kelantan. Kuala Rek, *S.F.N. 10204* (Haniff & Nur). — ANAMBAS ISLANDS. Terempah, Siantan, *S.F.N.20258* (Henderson). — SIAM. Muang Wing, 440—500 m, *Eryl Smith 1827*.

2. *Heterogonium wiganii* (Racib.) Holtt., *comb. nov.*

Aspidium wiganii Racib. in Bull. int. Acad. Cracovie, Cl. Sci. math. nat. 1902: 61.

Dryopteris wiganii C. Chr., Ind. Fil. 301. 1905; v.A.v.R., Malayan Ferns 192.

Lamina of fronds 55—75 cm long, pinnae to 25 pairs; middle fertile pinnae to 25 by 4 cm, lobed almost or quite to the costa, the lobes 2—3 mm wide, crenate, separated by sinuses as wide as or wider than lobes; lateral veins in lobes twice forked, sometimes with 2 sori; apices of pinnae acu-

minate and distinctly crenate, not narrowly caudate; lobes of sterile pinnae commonly 4 mm wide, sinuses as wide or less, edges of the lobes commonly serrate; upper surface of sterile pinnae bearing scattered coarse multiseptate hairs of one kind only, those on the costa only slightly smaller than those on the lamina and spreading.

TYPE.—Cult. Hort. Bot. Bog. 2K. XI. 13 (origin, Aru Islands).

With the exception of the Pulau Tioman specimen, the following are much larger ferns than typical *H. sagenoides*. The Pulau Tioman specimen agrees with the others in hairiness on the sterile fronds, and in the lobing of the fertile pinnae. Van Alderwerelt describes the fronds as up to 150 cm long (including stipe?) but I have not seen any so large; the above description is based on the existing Bogor specimens.

SPECIMENS EXAMINED.—MALAY PENINSULA. Pahang, Pulau Tioman, G. Rokam, 2000 ft, *S.F.N.18613* (Henderson). — MOLUCCAS. Morotai. *Main & Aden 817*. Ceram. Between Kabailo and Kabohari, 400 m, *Rutten 243*. Kp. Angar, 60 m, *Buwalda 5702*. — NEW GUINEA Neth. New Guinea, Pionierbivak, *Lam 682*. Cult. Hort. Bot. Bog. II K. VIII. 18.

3. *Heterogonium gurupahense* (C. Chr.) Holtt., *comb. nov.*

Dryopteris gurupahensis C. Chr. in Bot. Jb. 66: 45. 1934.

Dryopteris sagenoides var. *gurupahensis* C. Chr. in Svensk bot. Tidskr. 16: 95 f. 2. 1922.

Differs from *H. sagenoides* as follows. Fronds larger on well-grown plants, normally with 15 pairs of pinnae; pinnae not usually caudate at apex; fertile pinnae often cut almost or quite to the costa, the lobes often crenate or lobed; upper surface of sterile pinnae bearing scattered coarse 7—8-celled hairs 1.5 mm long, and also very slender 2—3-celled hairs 0.2—0.3 mm long.

TYPE.—North Celebes, Bolaäng Mongondow, Gurupahi, 600 m., Kaudern 17, 18 (at Stockholm).

The original description of variety *gurupahensis*, to which nothing was added when the author raised its status to that of a species, reads "a forma typica differt; major, stipes 30 cm, lamina 60 cm longa, ad 30 cm lata, pinnis numerosioribus (ad 15-jugis)."

Through the courtesy of Dr. Olof Selling, I have been able to examine a pinna of a sterile frond of the type collection. The upper surface bears hairs of two kinds as above described, but the hairs of both kinds are less abundant than in specimens from the Malay Peninsula which I refer to this species, and from which the above description was in the main prepared. In Malaya, the species has been collected mostly at 1,000—2,000 ft. altitude, in forests on the Main Range (west side), Taiping Hills, and Penang.

SPECIMENS EXAMINED.—MALAY PENINSULA. Malacca. *Harvey s.n.* Negri Sembilan. G. Angsi, 2,000 ft, *S.F.N.11542* (*Md. Nur*). Selangor. Ginting Simpah: 1,500 ft, *Hume 8445*; 2,500 ft, *S.F.N.31192* (*Holtum*). Perak. Ulu Temengoh, *Ridley 14194*. Upper Perak, 300 ft., *Wray 3127*. Taiping, *Ridley s.n.*, 1909. Gopeng, *King's Collector 529*. Near Ulu Kerling, 400—600 ft., *King's Collector 8742*. *Scortechini, s.n.* Ulu Kal, 1,200—1,500. ft., *King's Collector 10779*. Penan. *Curtis 585*. Penara Bukit, *Ridley s.n.*, Dec. 1895. — SIAM. Koh Chang, *Marcen 1234*. Bandon, Surat, *Eryl Smith 3057* (*Herb. B.M.*). Mergui. *Griffith 874* (*Herb. B.M.*). — CELEBES. Lelemao, Preho, *Kjellberg 2507*.

4. *Heterogonium subglabrum* Holtt., *sp. nov.*

Dryopteris sagenoides forma *contracta* v.A.v.R. in *Bull. Jard. bot. Buitenz. III* 2: 147. 1920.

Pinnae breviter stipitatae; pinnae steriles supra prope sinus solum pubescentes, infra glabrae; pinnae fertiles ad alam utrinque 3—4 mm latam incisae, lobi falcati, 4 mm lati, sinubus angustis separati.

TYPE.—Sumatra, Sibolangit, Lörzing 5520.

Recognizing the other species above described as distinct from *H. sagenoides*, the present one must also be separated, as it is more clearly characterized than either of them by the distribution of hairs, and also by its stipitate pinnae. Judged by the shape of pinnae alone, however, a sharp distinction is difficult to formulate.

SPECIMENS EXAMINED.—SUMATRA. Sibolangit, Lörzing 5520, 5529, 6339 (BO); *S.F.N.6444* (*Md. Nur*).

ADDITIONAL EXINDUSIATE SPECIES

Heterogonium subsageniaceum (Chr.) Holtt., *comb. nov.*

Aspidium subsageniaceum Chr. in *Bull. Acad. int. Géogr. bot.* 1906: 240.

Ctenitopsis subsageniacea (Chr.) Ching. in *Bull. Fan. mem. Inst., Bot.* 8: 311. 1938.

Dryopteris austrosinensis Chr. in *Bull. Acad. int. Géogr. bot.* 1907: 145.

Fronde to 120 cm or more long (excluding stipe); pinnae 20 pairs, 6—8 cm apart; largest (sub-basal) pinnae 23 cm long, 3.5—4 cm wide, lobed $\frac{2}{3}$ distance to costa, fertile lobes 7—8 mm wide, slightly crenate, separated by sinuses 2—3 mm wide; lowest pinnae similar but somewhat shorter, the middle lobes not much elongate; veins all free, the lateral veins on each costule commonly 2—3 times forked, 2 or 3 of the branches bearing sori; sori without indusia; upper surface of fertile frond glabrous except for hairs near sinuses and on costae and costules, lower surface quite glabrous.

The above is a description of the specimen in the British Museum from the type collection of *Dryopteris austrosinensis*. I have not seen

the type of *Aspidium subsageniaceum*, but both were seen by Ching, who stated that both were one species. The known distribution is Kweichow, Kwangsi, and Tonkin. This species differs notably from the free-veined exindusiate Malaysian species *H. teysmannianum* (Bak.) Posth. in its larger fronds and much wider fertile pinna-lobes with two or three sori on each vein.

Heterogonium subaequale (Rosenst.) Holtt., *comb. nov.*

Aspidium subaequale Rosenst. in Fedde, Repert. 12: 176. 1913.

Tectaria subaequale (Rosenst.) Copel. in Philipp. J. Sci. 9C: 5. 1914.

Dictyopteris subaequale (Rosenst.) v.A.v.R., Handb. Suppl. 323. 1917.

Stipe 50 cm or more long; frond about 60 cm long (?), pinnae c. 10 pairs, subbasal ones to 15 cm long by 4.5 cm wide, lobed $\frac{3}{4}$ or more towards the costa, basal lobe on each side sometimes free; lowest pinnae with sub-basal lobes to 5 cm long, basal ones free (acroscopic longer than basiscopic); venation and sori as in *H. profereoides*; upper surface of lamina bearing very short hairs near sinuses only.

TYPE.—Sattelberg, 100—1000 m, Keysser 107 (New Guinea).

I have not seen the type of this species, and owe the identification with it of a specimen of Carr's to Mr. A. H. G. Alston. The above description was prepared from Carr's specimen (Papua, Boridi, 4,000 ft., Carr 14935, Herb. B.M.). This species is very near *H. profereoides*, to which I formerly ascribed Carr's specimen, and perhaps should be united with *H. profereoides*, but the deeply lobed pinnae, with sometimes free basal lobes, are perhaps sufficiently distinctive to warrant a separation. Further study of specimens from New Guinea is necessary to decide this question.

