Hirosi ITO*: **Distribution of monolete and trilete ferns in eastern Asia and northern Oceania**

伊藤 洋*: 東部アジアと北部オセアニアにおける両面体胞子のシダと四面体胞子のシダの分布

There are two kinds of spore patterns in the ferns, namely monolete (bilateral) and trilete (tetrahedral). Every species has either monolete or trilete spores. The fern flora of a certain country or island is composed of definite species. Then, some of them are monolete species and the others are trilete ones. In general, the number of the former species is larger than that of the latter in Japan and the neighboring regions. It is obvious that the ratio of the number of the monolete species to that of the trilete ones (call it as *ratio m:t*) is fixed in a certain region. But, is it fixed among different regions or not? The author picked up eleven regions where the fern floras have been published by authoritative botanists or the author himself. He found an interesting regularity of the ratio m:t among these regions of Asia and Oceania spreading in the Northern Hemisphere.

Materials In Fig. 1. A–K are the regions picked up in this study. They are as follows.

A. Japan (excl. Amami Arch. and Okinawa Pref.). M. Tagawa: Coloured Illustrations of the Japanese Pteridophyta, 1959, published by Hoikusha, Osaka.

B. Japan (excl. Okinawa Pref.). T. Namegata & S. Kurata: "An Enumeration of the Japanese Pteridophytes" in T. Namegata: Collection and Cultivation of our Ferns and Fern Allies, 1961, publ. by Kajima-Shoten, Tokyo.

C. Ryukyu Islands. H. Ito: Filices Liukiuenses (1)–(5) in Bot. Mag. Tokyo **52**: 532–538, 583–590, 642–649, **53**: 23–28, 68–71, 1938–39.

D. Bonin Islands. H. Ito: Pteridophytes of the Bonin Islands in "Iden" **23**(8): 35–41, 1969.

E. Southern parts of the Ryukyu Islands (Okinawa Pref.). S. Hatusima & T. Amano: Flora of Okinawa, rev. ed., 1967, publ. by Okinawa Association of Biology.

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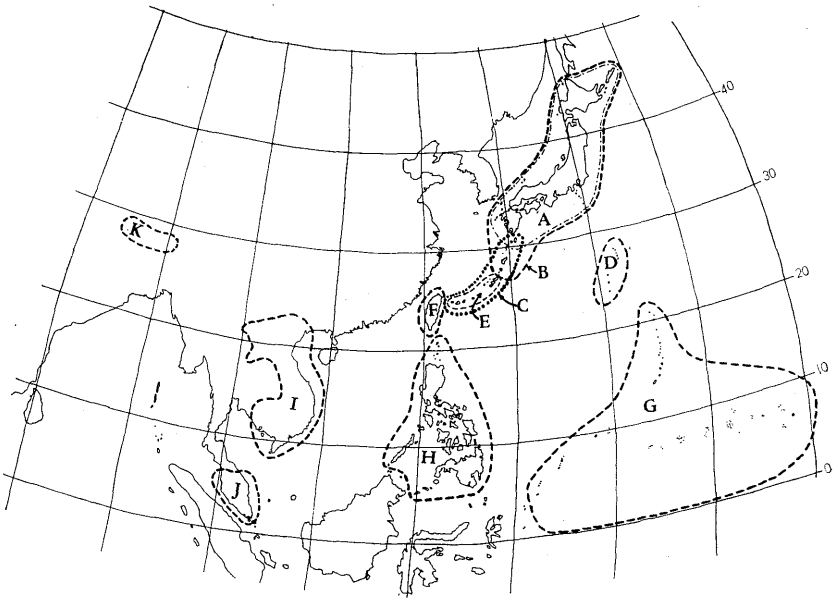

Fig. 1. A—K are the regions in this study.

F. Formosa. Wang-Chueng Sieh: A List of Formosan Species in "Ferns and Fern Allies", 1969, publ. by Chunghsing University, Formosa.

G. Micronesia. H. Ito: A List of the Micronesian Ferns, 1954. (Not published).

H. Philippine Islands. E.B. Copeland: Fern Flora of the Philippine Islands I–III, 1958–60, publ. by Bureau of Printing, Manila.

I. Indo-China. Tardieu-Blot & C. Christensen: "Fougères" in H. Lecomte: Flore Générale de l'Indo-Chine **6–9**: 1–544, 1939–41.

J. Malaya. R.H. Holttum: A Revised Flora of Malaya II, Ferns of Malaya, 1954, publ. by Government Printing Office, Singapore.

K. Eastern Himalaya. H. Ito, M. Tagawa, M. Nishida & K. Iwatsuki: "Pteridophyta" in H. Hara: Flora of Eastern Himalaya, 453–500, 1966; 2nd Rep. 197–221, 1971.

The fern allies are beside the question in this study, and the heterosporous ferns (Marsileaceae, Salviniaceae and Azollaceae) are excluded. Hybrid species are not included.

Results and discussion In Table 1 the number of species is out of the question, but the ratio m:t has some meaning. It is obvious that A (2.73) and B (2.69), D (1.67) and E (1.65), and also G (1.30) and H (1.27) have nearly similar values respectively. In these cases the regions are situated nearly at the same latitude each other. In addition to this the values increase in accordance with higher latitude—A, B>D, E>G, H. This fact is evident in the case of C (1.93) and E (1.65). C includes some northern islands beside E. In the case of A (2.73) and B (2.69), the existence of the Amami Archipelago in the Ryukyu Islands is effective in B. But the case E (1.65)

Table 1. A summary of the obtained results.

Symbol	Region	Latitude (North)	Number of species	Monolete	Trilete	Ratio m:t
A	Japan (excl. Amami Arch. and Okinawa Pref.)	30°–46°	395	289	106	2.73
B	Japan (excl. Okinawa Pref.)	28°–46°	450	328	122	2.69
C	Ryukyu Islands (whole)	24°–31°	270	178	92	1.93
D	Bonin Islands	24°–28°	72	45	27	1.67
E	Ryukyu Islands (Southern parts)	24°–27°	212	132	80	1.65
F	Formosa	22°–25°	618	396	222	1.78
G	Micronesia	0°–23°	159	90	69	1.30
H	Philippine Islands	5°–22°	941	527	414	1.27
I	Indo-China	8°–23°	616	408	208	1.96
J	Malaya	2°– 7°	488	298	190	1.57
K	Eastern Himalaya	27°–28°	286	198	88	2.25

and F (1.78) the relation is reverse. Further remarkable reversal is seen in I (1.96) or K (2.25). In these cases the effect of the high altitude is considerable. To ascertain this opinion an attempt was made. In the material A the whole species of that region were divided into two groups, namely a group to which the warm-temperate and southern species belong, and another to which the temperate and northern species do. The boundary-line of the warm-temperate and temperate zones is shown in Fig. 2 as X–X which was proposed by the author in 1938. The results are as Table 2. This is a clear solution of this question. The ratio m:t of the temperate

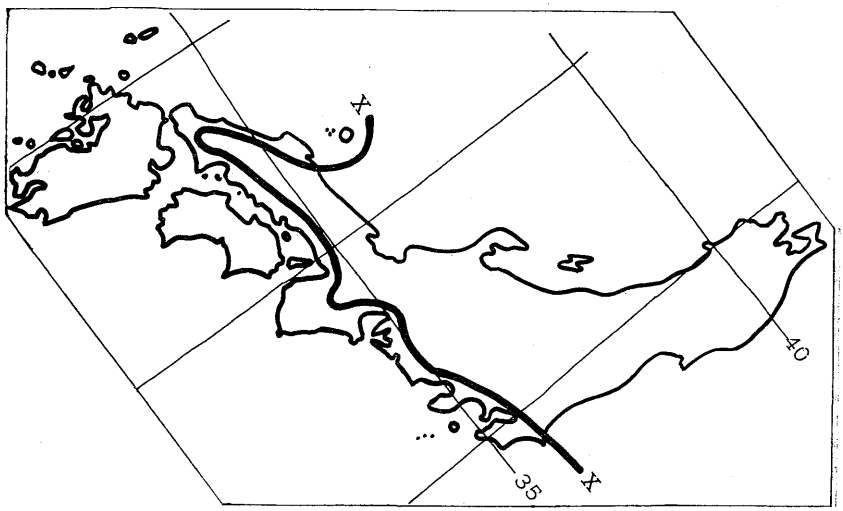

Fig. 2. X—X is the boundary-line of the temperate and warm-temperate zones in Japan.

Table 2. Two groups of the Japanese fern flora.

	Number of species	Monolete	Trilete	Ratio m:t
temperate and northern	144	31	113	3.65
warm-temperate and southern	251	74	177	2.39
total	395	105	290	2.73

and northern (subalpine to alpine) species is remarkably larger than that of the warm-temperate and southern (subtropical to tropical) ones. And the ratio of these two groups are also distinctly larger than that of the tropical species (for example G). It is easily recognized that the abundance of the temperate or subalpine elements in Formosa, Indo-China and Eastern Himalaya may increase the value of the ratio. In addition to this, an interesting value was obtained from Wales (Europe) whose situation is 51°20′-53°20′N (the material was H.A. Hyde, A.E. Wade & S.G. Harrison: Walsh Ferns, 1969, publ. by National Museum of Wales).

In conclusion the values of the ratio m:t increase in accordance with the latitude and altitude in the Northern Hemisphere. In other words the trilete ferns are abundant in the warmer regions and the monolete ferns are numerous in the colder regions.

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シダには両面体の胞子と四面体の胞子があり，種類によって どちらかの形の胞子をもっている。種類の数を比べてみると，日本などでは前者の方が多く，両者の比（本論ではこれを ratio m:t と呼ぶ）は 2.7 くらいである。この値が世界中一定であるか地域によって異なっているかを調べた。このため図1 の A-K の地域を選んだ。これらの地域はいずれも信用できるシダフロラが発表されている所である。この結果をまとめたものが表1で，この表からいろいろのことが考えられる。AとB，DとE，GとH など大体同緯度の所のものは似た値をとり，しかも高緯度のものほど値が大きい。このことはCとE，AとBなどで微妙に現われている。ところがEとFは逆になっており，IやK はおかしな値となっている。そこでこれらの地方に高い山がある関係ではないかと考え，次の調査をした。すなわち資料A（田川図鑑）に出てくる種類を分析して暖帯より南のものと温帯より北のものの2群に分け（この境界は私が 1938 年に設定した線の一つで図2の X-X で示した），それぞれの値を出したところ，表2のような結果になった。これには暖い方と寒い方とで大きな差が出ている。台湾やヒマラヤの値が大きくなっているのは温帯ないし亜寒帯や寒帯の 要素が含まれているためであることがわかった。そこで緯度が高くなるにつれ，また高度が上がるにつれて，値が大きくなるものであるという結論に達した。つまり寒くなるほど 両面体胞子をもつ種類の率が大きくなることになる。なおシダでは両面体のものは進んだものに多いことが知られているので，このような分布とからませてどう考えるかは 興味ある問題であるが，今回は特にこのことには触れなかった。