THE GLEICHENIACEAE OF TAIWAN AND ADJACENT AREAS

by

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In 1927 Nakai published a report on the Osmundaceae, Schizaeaceae and Gleicheniace of Japan in which he discussed the Gleichenias of Formosa (1927: 689–696). He listed the following four species from Taiwan. *Dicranopteris dichotoma, D. glauca, D. longissima* and *D. volubilis*. Sasaki (1928: 42–43) and Masamune, (1936: 30) listed the same species. Since then other species have been discovered and it is likely others remain to be found.

The Gleichenias are so different from other ferns that even a beginning student can distinguish them. There are about 120 species, and all but a few have at one time or other been referred to the genus Gleichenia.

Diels (1902) divided the genus Gleichenia into four sections but retained the genus name Gleichenia for them all.

Underwood (1907) followed by Maxon (1909), Nakai (1927) and others substituted the name Dicranopteris for those Gleichenias which have pectinate pinnae with linear ultimate segments, and with sori borne dorsally on the veinlets; and they retained the name Gleichenia for those ferns having ultimate segments in the form of small rounded lobes, and having sori borne terminally on the veinlets. Thus the name Dicranopteris came to be a synonym for most of the species that had been previously called Gleichenia.

Christensen (1938: 530) suggested breaking the family up into seven genera, but he did not go ahead and give a detailed description of these genera nor did he make the new combination of names for all the species.

Ching (1940a) who had worked with Christensen in Copenhagen, published a paper in 1940 "On the Genus Gleichenia Smith" in which be followed through with Christensen's basic suggestions.

On account of World War II, St John and Copeland did not see Ching's paper of 1940. They also followed Christensen's ideas, and St John, (1942: 80) and Copeland, (1947: 26–29) made use of the newly suggested genera and made many new combinations of names. In the genus Hicriopteris many of the new names proposed by Copeland were just the same as Ching had previously made.

Holttum (1954) gives an excellent treatment of the species from Malaya, but he retains the genus name Gleichenia for all of them, using the terms Dicranopteris, Hicriopteris and Sticherus as subgenera names.

Nakai (1950) went into the classification of the Gleicheniales in great detail. That

year he attended the Second Biennial Conference of the Council of Museums in London, and while there took time to study the Gleichenias in the herbaria of the British Natural History Museum and that of the Kew Gardens. Christensen's collection had beed sold to the British Natural History Museum and thus he had the opportunity to study his fern collection, also Christensen's photograpns of type specimens and sketches.

In a general way Nakai accepted Christensen's division of the family. He had not seen Ching's paper of 1940 so a number of the combinations of new names that Nakai made were the same as those that Ching had made ten years earlier. However he did not fully accept St John's (1942) and Copeland's (1947) treatment of some groups. So far as our Taiwan ferns are concerned the greatest difference is regarding the treatment of the revived genus Hicriopteris. To Ching and Copeland Hicriopteris was a group of about a dozen species characterized by being bipinnate above the last fork and having veinlets that only forked once. Nakai insisted that the type of true Hicriopteris is *H. speciosa* Presl which has its veinlets anastomosing near the margin with free excurrent veinlets, and so for this and other reasons he used Diplopterygium as the name of the genus of the *Gleichenia glauca* group; a name which had been previously proposed by Diels (1902) for this section of Gleichenia.

Nakai never saw any specimen of *H. speciosa* and I have never had an opportunity to see this Indian fern. Nakai may have been correct in separating this fern from the *Gleichenia glauca* group, but for the present I am using the name *Hicriopteris* in the sense that Ching (1940) Dickason (1946) and Copeland (1947) have done.

To date, only the two genera: Dicranopteris and Hicriopteris have been found on Taiwan. Most species of true Gleichenia (including Calymella and Gleicheniastrum) are from the Southern Hemisphere but a few species extend to the Philippines, Borneo, Java, Malaya, and Indo-China. Sticherus in mostly a New World genus but some of its species are also found in Borneo, Java, Malaya, Indo-China and the Philippines.

Like many others, Nakai had an unpleasant experience as a result of World War II. In April 1946 he was sent to a camp on Galang Island of the Rhio Archipelago; (a tiny island south of Singapore); and like many others, including myself, as a result of the war had an opportunity to see ferns he would otherwise never have seen. Some of the ferns he saw there also grow in Formosa and his observations on some of the Dicranopteris are of interest to us here.

Just recently a copy of Masamune's revision of Taiwan plants has come to hand. It is a mimeographed paper published in 1954 entitled "A list of vascular plants of Taiwan". He says in the introduction it is based on information available to him up and until 1945. In this list he distinguishes between Dicranopteris and Hicriopteris, and lists the following species:

Dicranopteris dichotoma Bernh. *Hicriopteris blotiana* Ching, *H. cantonensis* Ching, *H. glauca* Ching, *H. longissima* Ching and *H. volubilis* Ching. Evidently he was not aware of some of Tagawa's collections and papers.

Key to the genera of the Gleicheniacae growing in Eastern or Southeast Asia

1. Ultimate pinnules roundish, only 1–2 mm. long; sori terminal on veinlets ..... *Gleichenia*
1. Ultimate pinnules or segments linear, 1 cm. or more long; sori dorsal on veinlets 2
2. Fronds bipinnate above the last fork, veinlets only once forked; terminal bud covered with scales ..... *Hicriopteris*
2. Frond pinnate above the last fork 3
3. All or nearly all rachis branches leafy; without reflexed accessory pinnae at forkings; veinlets only once forked; sori with up to 6 sporangia ..... *Stichorus*
3. Only ultimate branches leafy; with reflexed accessory leafy pinnae at the forkings, ultimate veinlets in groups of 3–6; terminal bud covered with hairs; sori with more than 6 sporangia ..... *Dicranopteris*

Dicranopteris Bernh.

Rhizome creeping, protostele, sparsely covered with deciduous, multicellular, straight, branched or stellate hairs; stipes far apart, erect, varying greatly in length, often glossy, glabrous; fronds pseudo-dichotomously branched; rachis repeatedly forked; terminal buds protected by stiff hairs and usually with small foliaceous stipule-like bracts; ultimate branches leafy and at the base of each branch most species have a pair of reflexed leafy accessory pinnae; ultimate pinnae deeply pinnatifid or pinnate; segments; linear veinlets 3–6 in each group; sori dorsal on veinlets with over 6 and usually between 10–20 sporangia per sorus.

Key to species

1. Both surfaces of lamina and rachillae glabrous 2
1. Both surfaces of lamina (especially at the base of the midrib), and the rachillae covered with small deciduous, reddish-brown stellate hairs ..... *D. linearis*
2. Ultimate segments 1.5–3 cm. long, 3 mm. broad; veins in groups of 3 or 4's, axillary bud protected by dark brown hairs and very small leafy bractss; the short leafy branches occur on alternate sides of main rachis; a very tall slender fern, scandent among trees ..... *D. Warburgii*
2. Ultimate segments 5–10 cm. long; 4–6 mm. broad; veins in groups of 4 to 6; axillary buds protected by hairs, but without bracts in all upper forks; a very stout, large fern, erect or trailing ..... *D. splendida*

Dicranopteris linearis Plate I. fig. 1.

Dicranopteris linearis (Burm.) Underwood, 1907: 250; Ching, 1940a: 274;

Polypodium lineare Burmann, 1768: 235 pl. 67.

Gleichenia linearis (Burm.) Clarke, 1880: 428; Beddome, 1892: 4 pl. 1; Ogata 1931, *4:* 180 pl.; Makino 1955: 964 fig.

Gleichenia dichotoma (Thunb.) Hooker, 1846, 1: 12.

Polypodium dichotomum Thunberg 1784: 338 pl. 37.

Dicranopteris dichotoma (Thunb.) Bernhardi, 1806: 38, 49. pl. 3. fig. 13; Nakai, 1927: 698; Masamune, 1936: 30; Copeland, 1947: 28. Ito 1944: 483 pl.; Liu, 1956: 77.

Rhizome protostele, widely creeping, 2–3 mm. thick, sparsely covered with stiff, yellowish-brown, septate hairs; stipe erect, brown, glossy, glabrous, except at very base which may bear stiff multicellular hairs, 20 cm. to 1 meter or more tall; fronds pseudo-dichotomously branched, rachises not leafy, with a pair of reflexed accessory leafy pinnae at each forking of the rachis; axillary buds covered with yellowish brown or reddish brown stiff septate hairs and a pair of small lobed or pinnatifid bracts; rachises and both surfaces of pinnae, covered with small easily abraded, stellate or straight, reddish-brown hairs, especially plentiful at the forkings and along midribs; ultimate branches leafy, these pinnate, 15–30 cm. long, variable in size, texture and form, undersurface glaucous; ultimate segments linear, apex obtuse or retuse; the longest segments usually near the base of the pinna; veinlets in groups of 3 or 4; sori generally with 6 or more sporangia, usually 7–9.

Habitat: Exposed hillsides, along railroad embankments, in the edge of forests.

Distribution: Korea, Japan, China, Indo-China, Burma, Malaya, India, Philippines, Islands of South Pacific, Australia, Hawaii, Africa and tropical America.

Taipei Hsien:

Hsin-tien, Suzuki-Tokio, 6931; Shimizu, 2231;

King-kua-shih, T. Ito II. 4, 1915;

Kuang-yin-shan, N. Fukuyama IV. 29, 1940;

Pei-tou, Tanaka VII. 19, 1930;

Shih-lin, Nonaka et Mori V. 15, 1932;

Taipei, S. Sasaki VII. 20, 1927; Lin 1. 15, 1940.

Miaoli Hsien:

Lu-chan-ta-shan, Fukuyama 3404.

Taichung Hsien:

Sekihekiko, S. Suzuki, XII. 15, 1922.

Nantou Hsien:

Chin-shui-kou, Huang 35;

Lien-hwa-chih, Yamamoto and Mori XI. 2, 1923;

Puli, Kudo;

Sun Moon Lake, Kudo and Sasaki IX. 17, 1929; Huang 1228; DeVol 7149.

Chiayi Hsien:

Mt. Ali, S. Sasaki 1929

Kuang-tze-ling, Morimoto 703; DeVol 6078;

Mei-shan, DeVol 7072.

Kaohsiung Hsien:

Chui-chow-tong, Matuda II. 15, 1915.

Pingtumg Hsien:

Kuskus, Kudo and Suzuki 16005.

Ilan Hsien:

Mt. Oobi, Masamune IV. 23, 1938.

Green Island (Kashoto), Kudo and Mori 231.

Kizan Island, Masamue and S. Suzuki 28.

Nakai held that *D. dichotoma* was distinct from *D. linearis* and that the common fern growing in Korea, Japan, China and Formosa should be called *D. dichotoma*. *D. dichotoma* is relatively a small fern seldom exceeding 1 or 2 meters and is often much shorter than a meter. (Plate I figure 1 is of this kind)

While Nakai was on Galang Island he saw *D. linearis*, and he was convinced that this was quite distinct from *D. dichotoma*. He said it grew more than 5 meters tall. It has been reported from tropical America as growing to the height of 20 meters, and Wagner (1947) in his article on Tree-climbing Gleichenias mentions that it grows up to 50 meters tall in the Admiralty Islands, where he saw it in the tops of tall trees.

D. linearis is widely distributed in many parts of the world. Nakai thought that *D. linearis* and *D. dichotoma* grow side by side in the rain forests of Formosa and Indo-China. He may have been correct in this opinion but since these two taxa are so similar, I have found no way to distinguish them except on the basis of height; so for the present I am considering them as as all being the same species.

In Taiwan beautiful baskets are woven from the long stipes and rachises of this and other species.

In *D. linearis* the longest ultimate segments are usually near the base of the pinnae, (the longest is usually only the 4th or 5th from the base) while in *D. Warburgii* the longest segments are near the middle of the pinnae, and become shorter both toward the base and apex. (Plate I Fig 2)

In *D. linearis* the pinnae vary widely in size and are often up to 30 cm. long, the pinnae of *D. Warburgii* are all about the same size and are usually 10–12 cm. long.

The texture of *D. linearis* is usually stiff and the two sides of a pinnae grow at a "V" shape angle, the texture of *D. Warburgii* is thin and the pinnae are flat, but

this is a matter of ecology, because *D. linearis* usually grows in dry exposed habitats; when in dense shade, its leaves have a thinner texture and its pinnae are flat. *D. Warburgii* nearly always grows in the shade of forest trees.

Dicranopteris splendids Plate II. fig. 1. Plate IV. fig. 3. Plate V. fig. 2.

Dicranopteris splendida (Hand-Mzt.) Tagawa, 1939: 164; Tagawa 1940: 203; Ching, 1940: 2; Ching 1940a: 275–276; Dickason, 1946: 119: Nakai, 1950: 69.

Gleichenia splendida Handel-Mazzetti, 1924: 81; Handel-Mazzetti, 1929: 16; Ching 1937, *4:* 153 pl.; Christensen and Tardieu-Blot, 1936: 173;

Gleichenia linearis (non Clarke, 1880.) Christensen, 1931: 271, pro parte.

Rhizome creeping, 4–5 mm. in diameter, covered with deciduous, long, glossy, stiff reddish-brown hairs; stipe olive-brown, erect, 5 mm. in diameter, up to 1.5 m. long, glossy, glabrous, but covered with reddish brown hairs at base, fronds up to 2 or 3 m. tall. 5 or 8 times dichotomously forked, bearing a pair of reflexed pinnae at the base of each forking of the upper rachises, (the lower 3–5 forks are without reflexed pinnae in all specimens collected from Nantou Co.); rachises glabrous; axillary bud covered with stiff brown hairs and without leafy bracts, or only the lowest buds protected by two small ovate pinnules; pinnae 15–25 cm. long, 4–9 cm. broad, gradually narrowed on both sides towards apex, base decrescent on upper side; segments linear, 5–9 mm. broad, apex obtuse, usually retuse; veinlets 4–9 in each group usually 5–6; sori composed of 10–20 sporangia, borne on anterior veinlets at the base.

Habitat: Exposed hillside.

Distribution: Burma, Khasia, Indo-China (Laos, Annam, Tonkin), South China (Yunnan, Kwangsi, Kwangtung, Hongkong), Taiwan.

Pingtung Hsien: (between Kuwarsu and Masisi, Tyosyugun) Tsao-Chou, Tagawa 2225.

Hwalien Hsien: Between Tairogo Gorge and Harokudai, Tagawa 3384.

Nantou Hsien: Chin-Shui-Kou, Huang, Kou, Kao 1048. Chi-tou, Huang 1397, 1489.

All specimens from Nantou Hsien are without reflexed pinnae at the lower 3 to 5 forks, and the upper axillary buds are without leafy bracts. I have not seen Tagawa's specimens collected from Pingtung and Hwalien Hsien, and we do not have specimens in the NTU Herbarium from other parts of South East Asia. Ching's figure in Icones Filicum (1937: *4:* 153) shows the reflexed pinnae, and leafy bracts on the lower forks.

Dicranopteris Warburgii Plate I. fig. 2. Plate IV. fig. 4. Plate V. fig. 3.

Dicranopteris Warburgii (Christ) Nakai, 1950: 70.

Gleibhenia dichotoma var. *alternans* Mettenius, 1863: 51 fig. Hooker and Baker 1868: 15, Christensen 1937: 35.

Gleichenia Warburgii Christ 1897: 78, 1900: 92; 1906: 1009–1010. Diels 1901: 353, Rosenburgh, 1908: 795.

Gleichenia linearis (Burm.) Clarke var. *alternans*. Mett. Holttum, 1954: 70, and colored frontispiece.

Dicranopteris linearis (Burm.) Underw. var *alternans* Mett. in Ching, 1940: 274–275.

Dicranopteris scandens DeVol. In herbarium.

Rhizome protostele, widely creeping, 4–5 mm. thick, sparsely covered with long, stiff, glossy, yellowish or brownish multicellular hairs; stipe erect, glossy, brown, glabrous, up to 2 or 3 m. tall, hairy only at base; fronds with a pair of reflexed pinnae at each forking of the rachis, upper pairs of reflexed pinnae about 4 cm. long (rarely up to 6 cm.), at each lower forking they are longer, the lowest ones 8–10 cm. long; terminal pinnae usually 10–13 cm. long, rarely up to 22 cm. long, glaucous beneath; without hairs or scales on rachis or veins, or on either surface of lamina; one leafy branch developed at each fork, the branches alternate on either side of the main rachis; veinlets usually in groups of 3, sometimes 4; axillary bud completely covered by 2 very small simple obtuse green bracts and surrounded by very stiff, jointed, glossy, dark brown or blackish hairs; ultimate segments linear, very closely placed, the longest segments usually being nearest the middle of the pinnae; sori with 7–10 or more sporangia.

This is a new record for Taiwan. I first saw this fern in the summer of 1957 growing in the woods around Sun Moon Lake. It is so distinct from *D. linearis* that one has no difficulty in detecting it even from a distance. It grows to be a tall fern and climbs among the trees reaching a height of several meters. The pinnae are short, usually 10–13 cm. long, but occasionally up to 22 cm. long and its under surface is white. The side branches which bear the leafy pinnae, alternate on either side of the rachis. The fronds of this species are glabrous from the beginning, but those of *D. linearis* always have reddish brown hairs on both surfaces of the lamina and although many of its hairs may become abraded it is never truly glabrous.

This fern has been collected in several localities in Nantou Hsien, There was one unnamed specimen in the Dicranopteris folder in the NTU Herbarium collected by S. Sasaki in VII. 25, 1932, and a specimen collected by Hibino and Suzuki labelled *D. dichotoma*.

Habitat: On wooded hillsides, usually growing in shade.

Distribution: Thailand, Malaya, Borneo, Philippines, Papua, Micronesia, Taiwan.

Taipei Hsien:

Uraisya (Wulai), S. Sasaki VII. 25, 1932;

Kankou, M. T. Kao 3625.

Nantou Hsien:

Rengechi (Lien-hwa-chih), S. Hibino and S. Suzuki VII. 17, 1936;

Sun Moon Lake, DeVol 6038, 7150, 7297, 7477; DeVol & Huang, 1208, 1228;
Ching-shui-kou, Huang, Kou and Kao 1049, 1050, 1071.
Chi-tou, Huang 1490.

Hwalien Hsien:

Ching-shui, Kao 1707, 1743.

HICRIOPTERIS

Rhizome thick, creeping, protostele, covered with lanceolate scales; stipes far apart, stout, erect; fronds with 2 large primary pinnae at apex of stipe; primary pinnae bipinnate, often up to 2 meters long (but rarely only 30 cm. long); pinnules with many linear pectinate segments; veins only once forked; axillary bud covered with imbricating scales and usually by a pair of pinnately divided stipule-like bracts; sori composed of 2 to 6 sporangia; axillary bud may grow and produce a rachis continuous with the stipe and another pair of pinnae, similar to the primary pinnae, this process may continue until the top of this fern is growing in the branches of high trees, but not all species have this character.

Key to species

1. Axillary bud surrounded by scales only, without foliaceous bracts; ultimate segments oblique to costa, apex acute ..... *H. laevissima*
1. Axillary bud surrounded by scales and pinnately divided stipule-like bracts; segments at right angles to rachis, apex obtuse 2
2. Stipe and rachis not scaly, undersurface not scaly (or young fronds may have reddish brown stellate hairs on margins and apices of ultimate segments and a few stellate hairs on undersurface 3
2. Stipe and rachis more or less scaly 4
3. Under surface of fronds glaucous ..... *H. glauca*
3. Undersurface of fronds green, not glaucous ..... *H. glauca* var. *concolor*
4. Scales on stipe and rachis lanceolate with ciliate margins; stipe and rachis brown, glossy ..... *H. chinensis*
4. Scales on stipe and rachis very small, stellate, reddish brown; stipe and rachis green turning yellowish 5
5. Pinnules at right angle to the rachis of pinna ..... *H. longissima*
5. Pinnules oblique to rachis, all bent backwards ..... *H. Norrisii*

Hicriopteris chinensis Plate II. fig. 2. Plate IV. fig. 4.

Hicriopteris chinensis (Rosenst.) Ching, 1940a: 279.

Gleichenia chinensis Rosenstock, 1914: 120.

Dicranopteris chinensis (Rosenst.) Tagawa, 1939: 91.

Dicranopteris volubilis (Jungh.) Nakai, 1927: 691; Masamune, 1936: 30; Ito, 1944: 487 pl.

Rhizome creeping, scaly; stipe long, 4–5 mm. thick, brown, shiny, scaly; scales on stipe and rachis of pinnae lanceolate, with ciliate margins; primary pinnae over 1 m. long, 25. cm or more broad, covered with brown stellate hairs and narrow scales on upper side along the midrib of pinnules, and on the under surface along the midrib of pinnules, and on the undersurface along the midrib and veinlets; the pinnae are long, lanceolate, with about 3 pair of basal pinnules shortened; ultimate segments at about right angles to costa, apex retuse; axillary bud surrouuded by linear lanceolate scales with fimbriate margins, and deeply pinnatifid bracts; sporangia covered by scales when young; sori consist of 3 or 4 sporangia.

Distribution: Indochina, China (Kwangsi, Kweichow, Fukien), Taiwan.

Taipei Hsien: Wulai (between Urai et Agyoku) S. Suzuki X. 22, 1932; Faurie, 238.

Hsinchu Hsien: Mabutoku, Y. Simada 4958 D; Ta-tung-ho (Taitōka), Kawakami et Mori 1411;

Nantou Hsien: Lien-Hwa-Chih (Rengechi), K. Mori VII. 7, 1936.

True *H. volubilis* which grows in Java does not occur on Taiwan and specimens so identified should be referred to this species as was pointed out by Tagawa (1939). This is not a common fern on the Island. Its dark brown stipe and rachis and the lanceolate fimbriate scales on the stipe and rachis makes it easy to distinguish from the other Taiwan species.

Hicriopteris glauca Plate IV. fig. 2. Plate V. fig. 1.

Hicropteris glauca (Thunb.) Ching, 1940a: 279; St John, 1942: 81; Copeland, 1947: 28–29; Masamune, 1954: 3.

Polypodium glaucum Thunberg, 1784: 338.

Gleichenia glauca (Thunb.) Hooker, 1846, *1:* 4; Ogata, 1931, *4:* 178 pl.

Gleichenia japonica Sprengel, 1827: 25; Copeland, 1909: 26.

Dicranopteris glauca (Thunb.) Underwood, 1907: 249. Nakai, 1927: 693; Suzuki, 1931: 112; Masamune, 1936: 30; Ito, 1944: 484 Pl.; Liu, 1956:77.

Diplopterygium glaucum (Houtt.) Nakai, 1950: 51.

Rhizome creeping, scaly; rhizome scales lanceolate, dark brown, margins fimbriate; stipe green, longitudinally grooved on one side, glossy, glabrous, not scaly, up to 1 m. long often only about 30 cm. long; frond divided into two large primary pinnae at top of stipe; axillary bud may develop producing a rachis and pinnae at the top; pinnae usually about 30 cm. long and 15 cm. broad when growing in exposed places, but growing up to a meter long and 30 cm. broad in shady habitats, undersurface usually very glaucous; ultimate segments pectinate, 5–15 mm. long (usually about 10–

mm.), apex obtuse; margins of segments on very young fronds have reddish stellate hairs and in occasional specimens the undersurface has stellate hairs, the first segment on the basiscopic side of each pinnule bears a short linear lobe which reaches across the rachis on its upper side; axillary bud surrounded by dark brown fimbriate scales, and deeply pinnatifid bracts; rachis of pinna ridged on upper side; sori of 2–4 sporangia.

Habitat; Exposed hillsides and wooded slopes.

Distribution;

Korea, Japan, Ryukyu, Taiwan, Philippines, China, Indochina, Thailand, Malay, Burma, India.

Taipei Hsien:

Seven Star Mt. (Tsi Hsin Shan or Shichisei), Sasaki x. 1927, v. 1932.

Pei-tou, Murakami 497;

Taipei, Suzuki-Tokio 7140, 18495.

Hwalien Hsien:

Ching-shui, Kao 1753.

Taoyuan Hsien:

Ta-Hsi-Shan (Taikeigun) Suzuki-Tokio 18224.

Taichung Hsien:

Ta-hsueh-shan, Huang 1820.

Chiayi Hsien:

Mt. Ali, S. Suzuki 1. 26, 1922; DeVol 7251.

Nantou Hsien:

Chi-tou, Huang 1507.

Taitung Hsieh:

Mt. Tawu (Daibu) S. Suzki 6996, Shimizu 3817.

H. glauca has a wide distribution on Taiwan. It is usually found on mountains at altitudes over 1000 meters. This fern is not scaly on its main stipe, except at its base. It frequently grows on exposed hillsides; when growing in the shade it becomes a very tall fern.

Hicriopteris glauca (Thunb.) Ching var. ***concolor*** Nakai (Ching 1940a: 280)

Dicranopteris glauca var. *concolor* Nakai, 1927: 694.

Diplopterygium glaucum var. *concolor* Nakai 1950: 52.

H. glauca var. *concolor* is very similar to *H. glauca* except its undersuface is green.

Distribution:

Japan (Kyushu), China, Taiwan, Indo China (Tonkin).

Taichung Hsien:

Ta-hsueh-shan, Liu, Kao, Koh, Chuan and Huang 147.

This is a new record for Taiwan.

Hicriopteris laevissima

Hicriopteris laevissima (Christ) Ching, 1940a: 280; Dickason, 1946: 19; Copeland, 1947: 29.

Gleichenia laevissima Christ, 1902: 268; Copeland 1909: 25, pl. 14; Ching, 1937: *4:* 152 pl. Rosenburgh, 1916: 92;

G. kiusiana Makino, 1904: 139–140; Ogata 1931, *4:* 179 pl.

Dicranopteris laevissima (Christ) Nakai, 1927: 692; Ching, 1940: 2; Masamune, 1943: 32; Ito 1944: 485 pl.

Diplopterygium laevissimum (Christ) Nakai, 1950: 52.

Rhizome creeping, scaly; rhizome scales lanceolate or ovate lanceolate, reddish brown, glossy, entire; stipe 30–45 cm. long, 3 mm. thick, green or yellowish green, glabrous, not scaly; frond divided into two large pinnae at top of stipe; pinnae glabrous, 30–40 cm. long, 13–18 cm. broad, undersurface green, ultimate segments 1–1.5 cm. long, pectinate, oblique to costa, apex acute, margins revolute; veins once forked; sori of 3 or 4 sporangia; axillary bud covered with ovate-lanceolate, entire scales with attenuate apices.

Distribution:

Burma, Indochina, China (Yunnan, Szechuan, Kweichow, Kwangtung, Hainan, Kiangsi, Chekiang), Japan (Kyushu), Philippines (Luzon).

H. laevissima has not been reported from Taiwan, but it could very likely be growing here as this speecies has been found in the adjoining areas both to the north and to the south of Taiwan.

Hicriopteris longissima Plate III. fig. 1. Plate IV. fig. 1.

Hicriopteris longissima (Bl.) Ching, 1940a: 280; Masamune, 1954: 3.

Gleichenia longissima Blume, 1828: 250; Hooker 1846, *1:* 4, Hooker and Baker, 1865: 12; Holttum, 1954: 67.

Dicranopteris longissima (Bl.) Underwood, 1907: 249; Nakai, 1927: 672; Masamune, 1936: 30; Kudo and Sasaki, 1931: 11; Suzuki, 1931: 112; Ito 1944: 486 pl; Liu, 1956: 77.

Diplopterygium longissimum (Bl.) Nakai, 1950: 53.

Rhizome creeping, scaly; stipe 5–10. mm. thick; stipe and rachis yellowish-green; rachis covered with stellate hairs and small brown scales of various shapes, having setose margins with long basal projections; primary pinnae about 15 cm. long, lanceolate; pinnules at right angle to rachis, 25–30 cm. long, undersurface green, sparingly covered with reddish brown stellate scales on the lamina; ultimate segments linear, obtuse or acute, 13–25 mm. long; axillary bud covered with shiny brown scales having ciliate margins, and with deeply pinnatifid green bracts; basal pair of pinnules very short (7–8 cm.), deeply pinnatifid, folded over the axillary bud, its ultimate segments acuminate; sori of 3 or 4 sporangia.

Habitat: Edge of forests, roadside.

Distribution:

South China, Indochina, Malaya, Indonesia, Philippines, Polynesia, Australia, Taiwan.

Nantou Hsien: Sun Moon Lake (Nichigetsutan), Kudo and Sasaki 15026, DeVol 6039, 7508.

Chiayi Hsien: Mt. Ali, B. Hayata; G. Nakahara.

H. longissima grows in the mountains of Nantou Hsien and is much sought after for its long stipe and rachis which is used in basket making. Baskets made from this species are stronger and more durable than those made from Dicranopteris. Its pinnae are usually 1 meter or more long, it is not easily confused with any other species except *H. Norrishii*. See the notes under *H. Norrisii* for the differences between the two.

Hicriopteris Norrisii Plate III. fig. 2. Plate V. fig. 5.

Hicriopteris Norrisii (Mett.) Ching, 1940a: 280; Copeland, 1947: 29.

Gleichenia Norrisii Mett. in Kuhn, 1869: 165; Hooker and Baker 1872: 449, Beddome, 1873: 23 pl. 346; Beddome, 1892: 2; Christ, 1910: 213; Holttum, 1954: 67.

Diplopterygium Norrisii Nakai 1950: 54.

Gleichenia Blotiana Christensen, 1934: 103; Ching, 1936: 392.

Hicriorteris Blotiana (C. Chr.) Ching, 1940a: 279; Copeland, 1947: 29; Masamune, 1954: 3.

Dicranopteris Blotiana (C. Chr.) Tagawa, 1939: 91, Tagawa 1940: 203; Ching 1940: 4; Masamune 1943: 32.

Rhizome creeping, scaly; stipe green, longitudinally grooved on one side, erect, stout; primary pinnae lanceolate, about 120 cm. long; pinnules mostly falcate, all bent backwards, i. e. the pinnules all slant towards the base of the pinna; ultimate segments pectinate, very close together, about 1 cm. long, apex obtuse and usually retuse; undersurface with small dark reddish brown setose scales and stellate hairs on the veinlets; rachis scales stellate or lanceolate with stiff setose margins; axillary bud surrounded by glossy brown narrowly lanceolate scales with setose margins, and an acuminate apex, and by deeply pinnatifid green bracts; sori 2 to 4 sporangia.

This fern is very similar to *H. longissima*. It is found in the mountains of Nantou Hsien as well as in other districts, and often grows in the same areas with *H. longissima*. Its pinnules are all bent backwards on the rachis and especially so near apex of the pinna. In *H. longissima* the pinnules are at about right angles to the rachis. Holttum, 1954: 67, mentions a difference in the bud scales, ours, are about the same. The apex of the ultimate segments of *H. Norrisii* are usually retuse,

always obtuse, in *H. longissima* they are often acute; and this difference is especially noted in the basal pair of short pinnules.

Habitat: Usually in forest shade.

Distribution: Borneo, Malaya, Indo-China, South China (Hainan), Taiwan.

Nantou Hsien:

Chin-Shui-Keo, Huang 1915.

Lien-Hwa-Chi (Rengeti) Yamamoto et Mori XI. 2, 1932; S. Suzuki 5769.

Chi-tou, Huang 1467.

Ilan Hsien:

Nankotaizan, S. Sasaki XI. 1928.

Kaohsiung Hsien:

Takao, Fourie 237; Tagawa 2203, 2232.

Taitung Hsien:

Near Baribugai, Tagawa 2665.

H. Norrisii has been considered as being distinct from *H. Blotiana* by Ching (1940a: 279–280), Copeland (1947: 29) Nakai (1950: 49, 54) and others. But Ching (1940: 4) states that *D. Blotiana* is very closely related to *D. Norrisii* but differs in being smaller in all its parts. Holttum (1954: 67) has combined them and reduced *H. Blotiana* to a synonym. *H. Norrisii* was reported from Malaya and *H. Blotiana* from Indo-China. Tagawa (1939: 91) used *H. Blotiana* for the name of the Taiwan ferns. We do not have specimens in our herbarium from Malaya or Indo-China with which to compare ours.

Hicriopteris cantonensis

Hicriopteris cantonensis (Ching) Ching 1940a: 229.

Gleichenia cantonensis Ching 1936: 391; 1937: 151 pl.

Masamune (1954: 3) lists this from Taiwan. There is no specimen of this species in the Herbarium of the National Taiwan University nor in that at the Taiwan Forest Research Institute, and we have not collected it. It is possible that it occurs on Taiwan but Masamune did not give any locality records or cite any specimens in his latest list, so we do not know anything about the basis for his inclusion of this species.

Ching says that *H. cantonensis* is closely related to *H. glauca* but that it is much larger, has a wine-red stipe and rachis, the scales covering the axillary bud are only half as long; and his drawing shows no pinnatifid leafy bracts surrounding the axillary bud, nor does he mention this species having bracts in his description of it. *H. laevissima* does not have bracts surrounding the axillary bud, but nearly all other species do.

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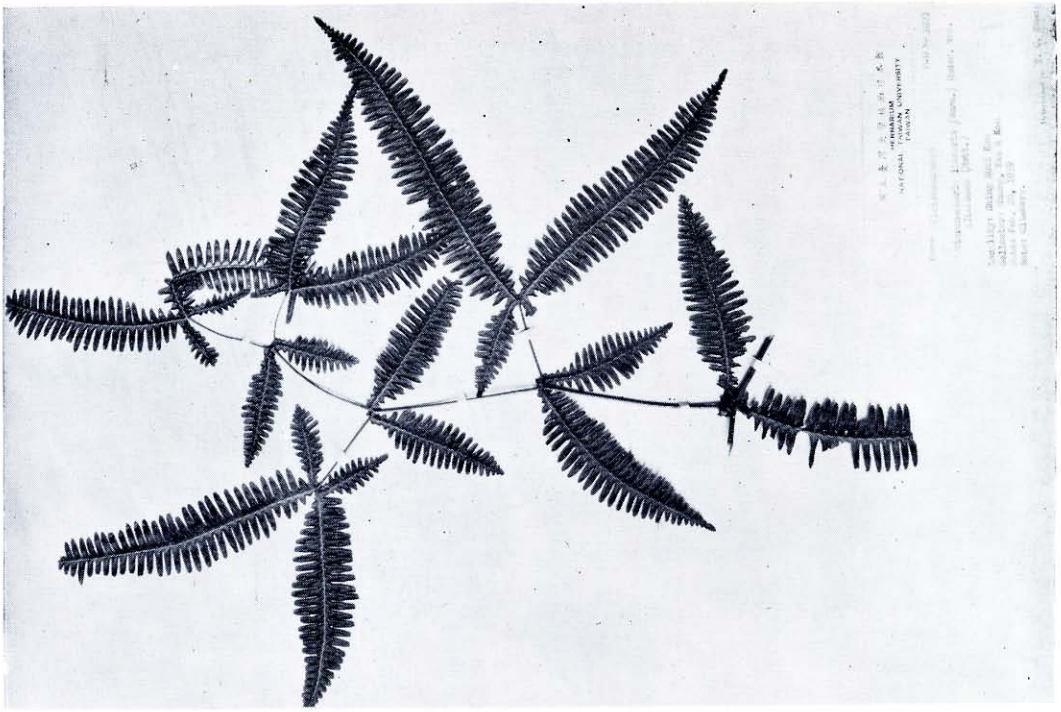
PLATE I

Fig. 1. *Dicranopteris linearis* (Burm.) Underw.
From Nantou Hsien, DeVol 7149. One of the commonest ferns on Taiwan. It usually has been known as *D. dichotoma* (Thunb.) Bernh. because it seldoms grows more than one or two meters tall on Taiwan. Note the pinnae are lanceolate being widest near the base and tapering to the apex.

Fig. 2. *Dicranopteris Warburgii* (Christ) Nakai
From Nantou Hsien, Huang 1071. A new record from Taiwan. Note the reflexed accessory branches at each forking of the rachis; that the leafy branches occur on alternate sides of the main rachis; and that the pinnae are almost linear, with the longest segments in the middle of the pinnae.



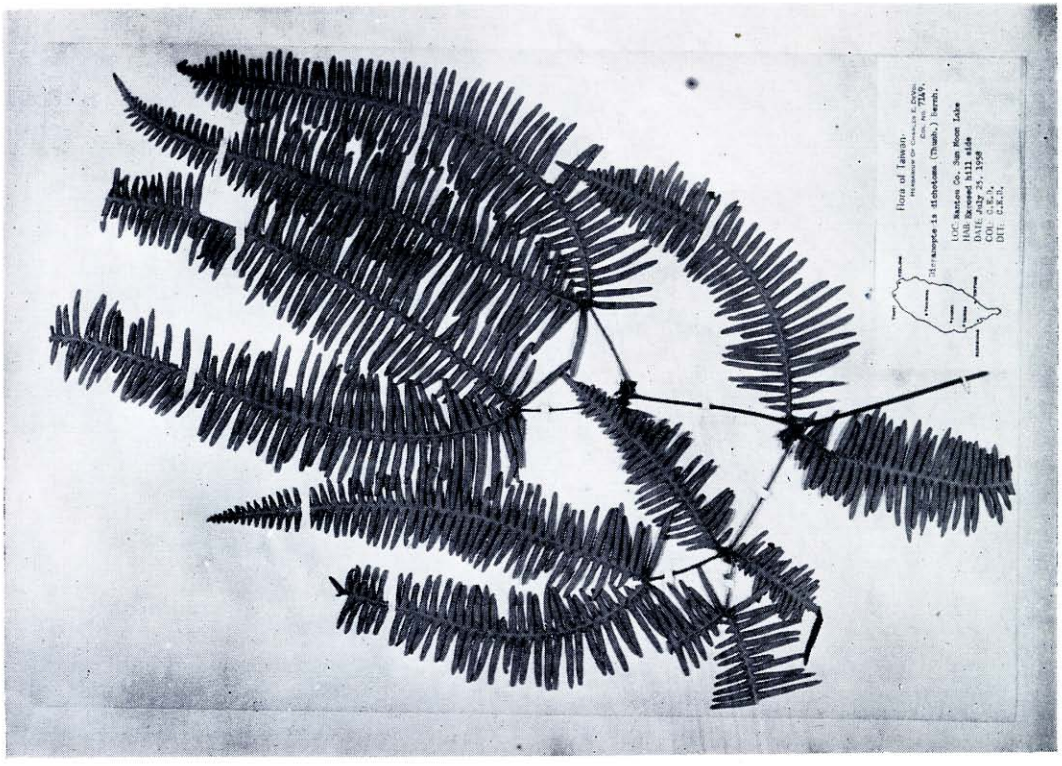
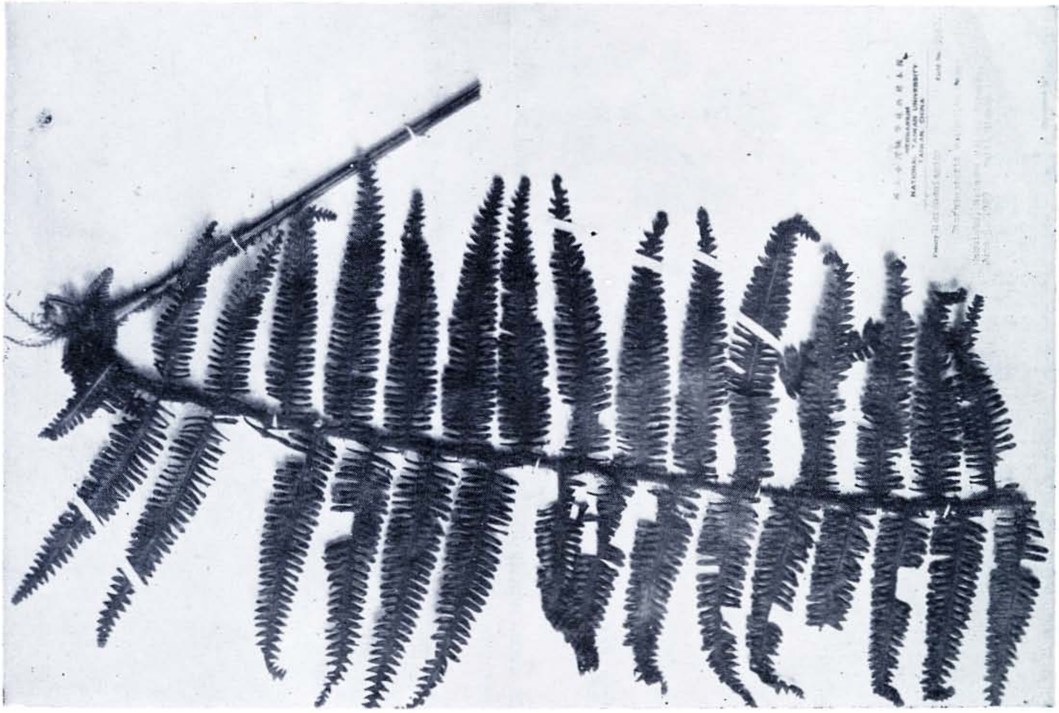

Flora of Taiwan
Dicranopteris dichotoma (Thunb.) Bernh.
LOC: Nantou Co. Sun Moon Lake
HAB: Exposed hill side
DATE: July 25, 1958
COL: C.D.V.
DET: C.D.V.

PLATE II

Fig. 1. *Dicranopteris splendida* (Hand.-Mtz:) Tagawa.
From Nantou Hsien,Huang 1929. Note that only the upper forks have reflexed accessory leafy branches (R.) also that the axillary buds (A) are without bracts. Branching is usually very regulary dichotomous.

Fig. 2. *Hicriopteris chinensis* (Rosenst.) Ching.
From Hsinchu Hsien, Simada 4985 D. The stipe and rachis is dark brown and covered with lanceolate fimbriate scales (also see Plate V Fig. 4.).

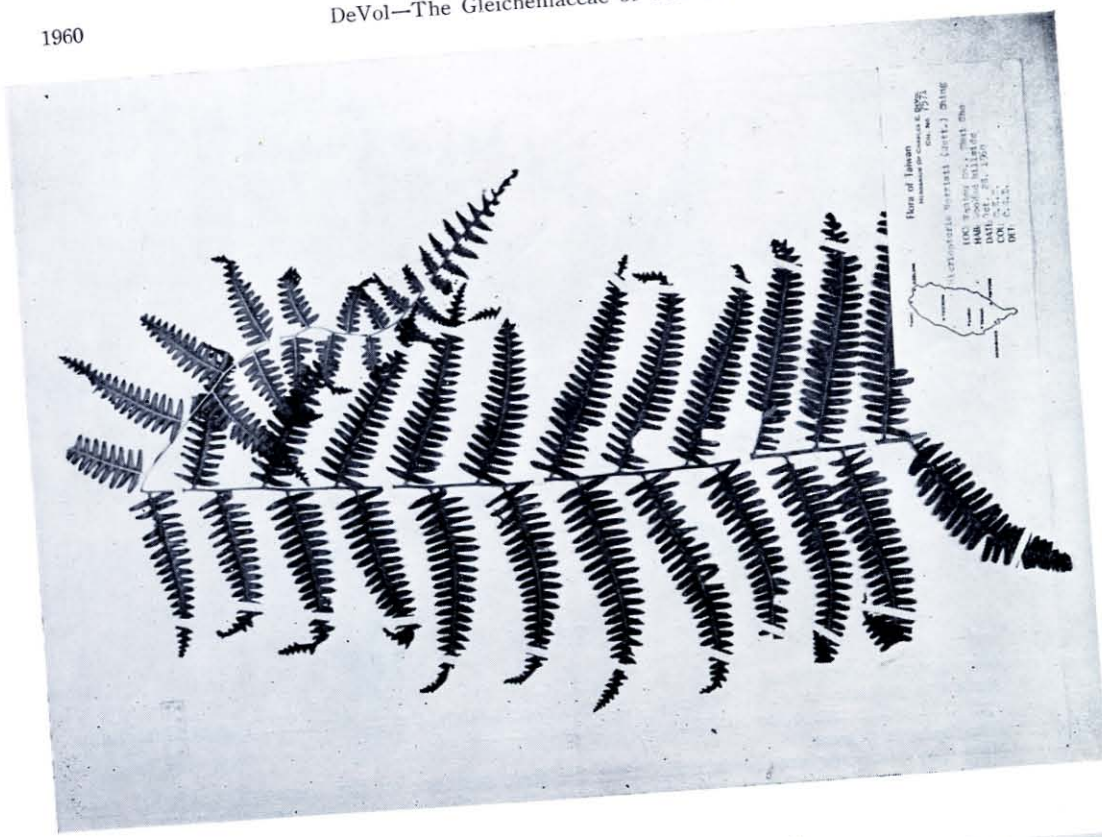



R
A

PLATE III

Fig. 1. *Hicriopteris longissima* (Bl.) Ching.
From Nantou Hsien, DeVol 7508. The pinnules are long and at right angles to the rachis. The pair of short basal pinnules fold over the axillary hud. The leafy bracts are deeply pinnatifid. Illustration is of the base of a pinna.

Fig. 2. *Hicriopteris Norrisii* (Mett.) Ching.
From Nantou Hsien, DeVol 7571. The pinnules are all bent back aad are often somewhat falcate. Illustration is of the apex of a pinna.



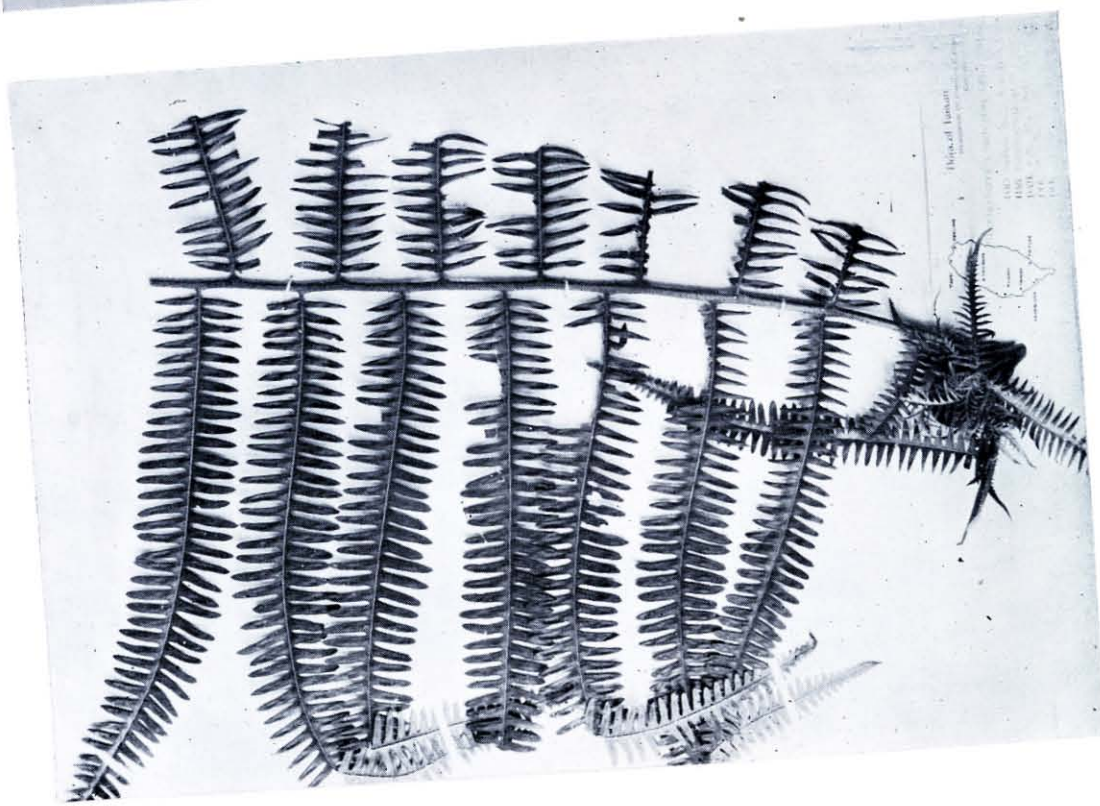


PLATE IV

Fig. 1. *Hicriopteris longissima.*
Note the pinnule is at right angles to the rachis, that the undersuface has stellate hairs, and that veins are once forked. (S.) Scale from rachis.

Fig. 2. *Hicriopteris glauca.*
Note the undersurface is glabrous, that the first segment on the basiscopic side of each pinnule has a linear lobe (L.) which crosses the rachis (R.). The rachis is ridged (D.).

Fig. 3. *Dicranopteris splendida.*
Note the sori occur on the anterior veinlet in each group of veinlets. Veinlets in the enlarged drawing are 4-5 in a group. Undersurface is glabrous. Axillary bud without any bracts.

Fig. 4. *Dicranopteris Warburgii.*
Veinlets in groups of 3 or 4. A pair of small bracts partially cover the axillary bud.

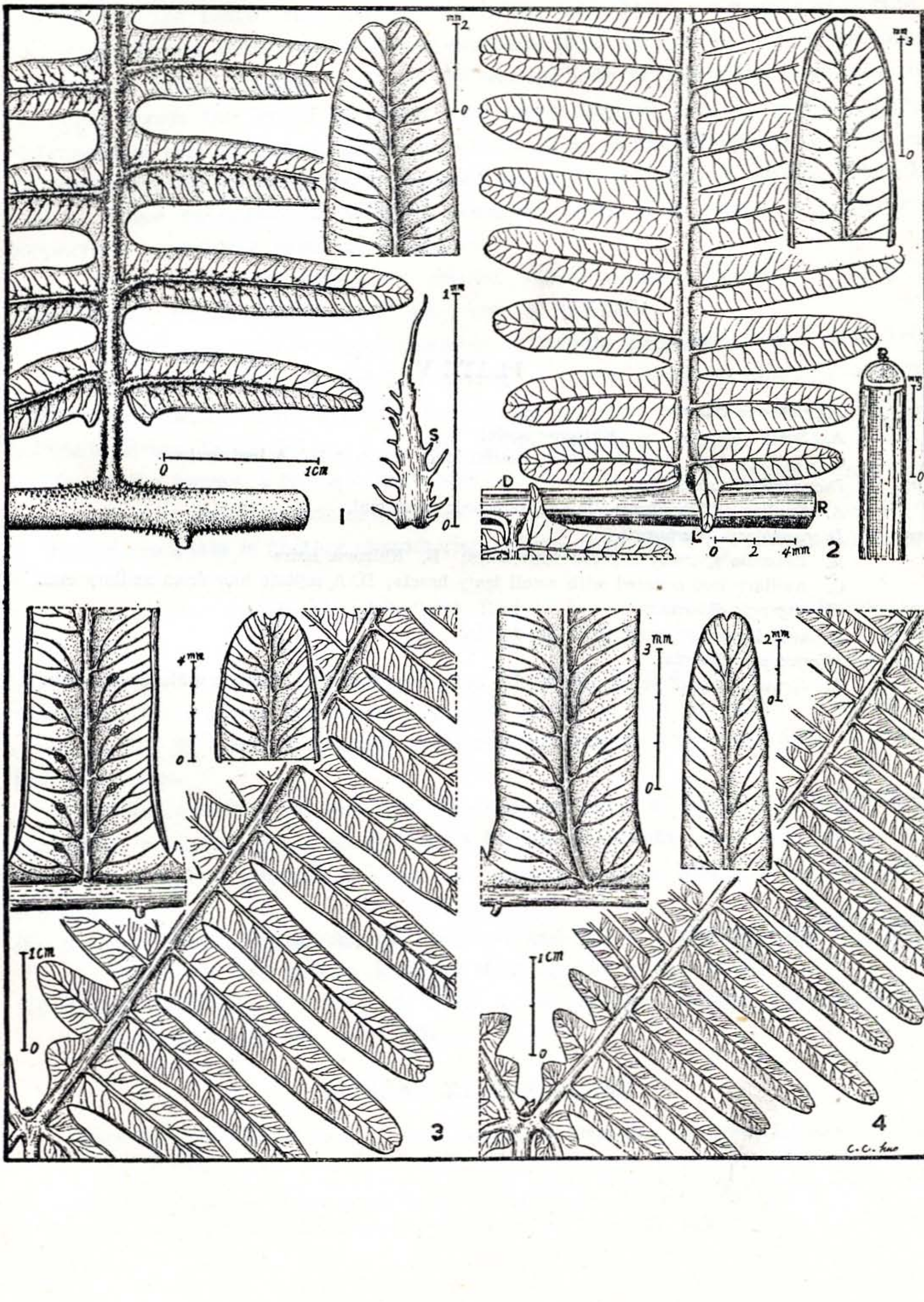

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PLATE V

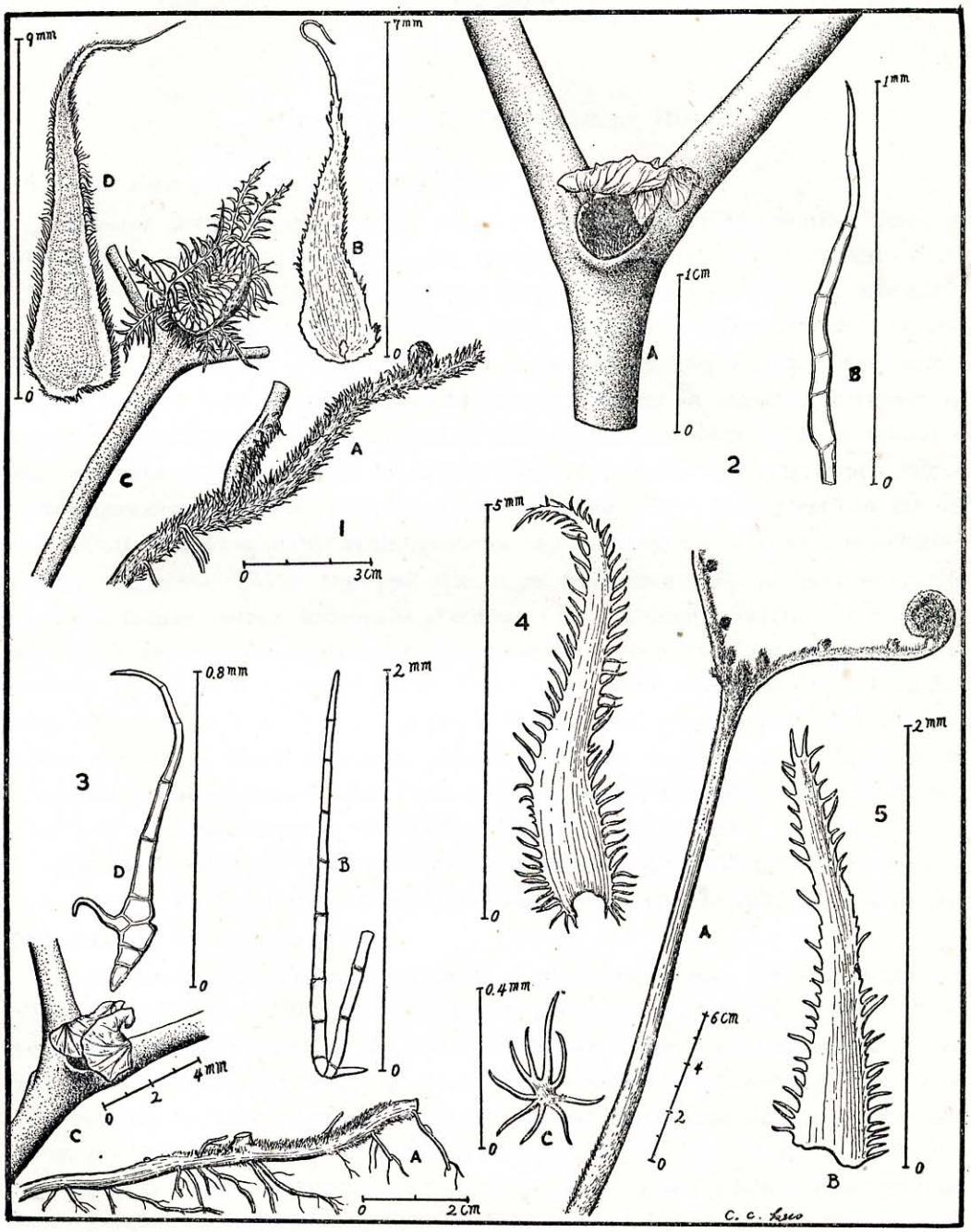
Fig. 1. *Hicriopteris glauca.*
A. Scaly rhizome; B. Rhizome scale;
C. Axillary bud covered with pinnatifid leafy bracts: D. A bud scale.

Fig. 2. *Dicranopteris splendida.*
A. Sunken axillary bud; B. Septate hair from bud.

Fig. 3. *Dicranopteris Warburgii.*
A. Rhizome sparsely covered with hairs; B. Rhizome hairs
C. Axillary bud covered with small leafy bracts; D. A septate hair from axillary bud.

Fig. 4. *Hicriopteris chinensis.*
A. large lanceolate scale from the rachis.

Fig. 5. *Hicriopteris Norrisii.*
A. Growing tip of young frond; B. Scale from bud; C. Stellate scale from rachis.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C. C. Lee