A LIST

OF THE

FERNS

OF

SIMLA

IN THE

N.-W. HIMALAYA

BETWEEN

LEVELS OF 4,500 AND 10,500 FEET.

BY

H. F. BLANFORD, F. R. S.

[*Reprinted from the Journal of the Asiatic Society of Bengal, Vol. LVII, Part II, No.* 4, 1888.]

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A List of the Ferns of Simla in the N. W. Himalaya between Levels of 4,500 and 10,500 Feet.—*By* H. F. Blanford, F. R. S.

[Received May 12th ;—Read June 6th, 1888.]

(With Plates XVI.—XXI.)

In the course of my summer residence at Simla during the last ten, and more particularly the last five, years, I have availed myself of such opportunities as have offered to collect and examine the materials for a list of the local ferns. The limits of my field of work have necessarily been determined by considerations of ready accessibility, and do not extend much below 4,500 feet on the one hand, nor above 10,500 feet on the other. I have, indeed, sometimes visited lower slopes and valleys both in the neighbourhood of Simla and in Chamba and the Jumna valley, but my examination of these lower levels has been too imperfect to admit of my attempting anything like so complete a list of their fern flora as for the range of elevations between the limits above specified. To the ferns occurring between 4,500 and 10,500 feet, therefore, this list is restricted.

In lateral extension, it takes cognizance of that portion of the Simla ridge which extends from the south-western limits of the station to the further side of Hatu, a distance by the Great Tibet Road of about 52 miles, but beyond the immediate neighbourhood of Simla my examination of the hill slopes has been restricted to levels above 8,000 feet.

As is well known, Simla stands on that ridge of the Himalaya which divides the drainage of the Sutlej from that of the Tonse and Jumna, the former a tributary of the Indus, the latter, of the Ganges, and is therefore a part of the main watershed of India. The outer hills, between Simla and the plains, are for the most part bare of forest, and the absence of shade and the dryness of the air which blows up from the plains during many months of the year are eminently unfavourable to plants so fond of coolness and moisture as the majority of the fern tribe. East of Simla, in the direction of the mountains, forests were at one time dense and vigorous, but for a distance of thirty miles most of those on the Simla ridge have now been either destroyed and cleared, or so far wasted and denuded of all their larger timber that, save where protected of late years, they present little more than stretches of brush-wood and small coppice. A few remnants, however, still exist at Mashobra and Mahalu ; and the northern faces and summits of Kumalhori and Hatu are still covered with magnificent forests, which afford rich ground for fern collectors and, indeed, botanists generally.

In the glens and valleys below Simla, destruction has been equally at work ; and there can be little doubt that, 20 or 30 years ago, the fern

flora of this neighbourhood was far richer in individuals and, to some extent probably, in species than it now is. In 1877 and 1882, in the course of a very superficial search, I obtained two or three species which I have since hunted for in vain; and, in a list of ferns collected between 1875 and 1877, drawn up by one who appears to have been a careful and competent collector, and published anonymously in the latter year, twenty-two other species and varieties are enumerated which I have not met with. Some few of these are doubtless from either lower or higher levels than those here adopted as limits, and one or two may be erroneous determinations, but it is very likely that several have since been extirpated.

The 1877 list enumerates 86 species and varieties; my own, not less than 101, and it therefore includes 37 which are not in the former; but 20 of these were not then described, or at all events had not been identified as Indian ferns, and some of them may possibly have been included under other and erroneous names. And five of my own list I consider as doubtfully distinct. It contains, therefore, but 12 distinct forms, well known as Indian in 1877, which escaped the former collector.

The names in the 1877 list which do not appear in mine, omitting those which have been changed, or which I have rejected, are the following:—

Trichomanes auriculatum.
Cystopteris fragilis (a high level form).
Cheilanthes rufa (a low level fern).
Pteris longipinnula.
Asplenium heterocarpum.
A. tenuifolium.
A. Hohenackerianum.
A. oxyphyllum.
Nephrodium gracilescens.
N. thelypteris.
N. cochleatum (a low level fern).
N. Brunonianum (a high level fern).
N. barbigerum (ditto).
N. sparsum.
N. setigerum (a low level fern).
Polypodium appendiculatum.
P. punctatum.
P. adnascens (possibly *P. fissum*),
P. hiemiontideum.
P. propinquum (perhaps *P. rivale*).
P. juglandifolium.
Gymnogramme tolla.

Of these, *T. auriculatum*, *Pt. longipinnula*, *Asp. heterocarpum*, *A. tenuifolium*, *Neph. gracilescens*, *N. setigerum*, *Pol. appendiculatum*, and *P. hiemiontideum* are not known from the N.W. Himalaya, and *Aspl. Hohenackerianum* not from Northern India, and some at least probably rest on erroneous identifications. *Cyst. fragilis*, *Cheil. rufa*, *Neph. cochleatum*, *N. Brunonianum*, and *N. barbigerum* are quoted either from higher or lower levels than those of my list. The others may either have disappeared of late years, or, if still existing in the neighbourhood of Simla, they have escaped my notice.

In the nomenclature of my list, I have generally followed Mr. Clarke's review of the ferns of Northern India, read before the Linnæan Society in June, 1879, and published in their Transactions; and I am indebted to Mr. Clarke and Dr. King for the identification of some forms, especially the *Diplaziums*, three of which I give on Mr. Clarke's authority. I should myself have considered these as mere forms of *Asp. polypodioides*, or perhaps rather *Aspl. umbrosum*. In a few cases, I have ventured to depart from Mr. Clarke's views, dividing specifically forms which he has associated, and associating others which he has, although with doubt, enumerated under different specific names. The following are the principal instances:—

Adiantum Edgeworthii is recognized as specifically distinct from *A. caudatum*. Col. Beddome has suggested the separation, and I fully concur with him.

Two varieties of *Cheilanthes farinosa* are separated from the type and so named. And *Cheilanthes Dalhousiæ*, as well as *Cheilanthes albomarginata*, are recognized as good distinct species. I have collected both largely and find them to be constant forms with no tendency to graduate into *Ch. farinosa*.

Wallich's *Asplenium (Athyr.) tenuifrons* is separated from *A. nigripes*, the habit, elevation, range, and character of the habitat of the two being quite distinct.

Mr. Clarke's *Aspl. filix fœmina*, var. *polyspora* has since been recognized as identical with A. Brongniart's *Athyr. Schimperi*, to which I have therefore referred it.

Wallich's *Athyr. pectinatum*, which Mr. Clarke treats also as a variety of *A. filix fœmina*, is also separated. It has a creeping root-stock and in other characters is sufficiently distinct and characteristic.

Mr. Clarke's *Neph. filix mas*, var. *normalis* passes by such indefinite gradations into the form which he identifies with *N. rigidum* that it is impossible to separate them. This appears to have been more than surmised by Mr. Clarke himself.

The Simla fern which has been referred to *Neph. canum*, J. Smith,

is inseparable from *N. prolixum*, as also Mr. Clarke suspected; I learn from Mr. Baker that the original habitat of the type is unknown, and the Simla ferns do not correspond with it very closely. *N. canum* is therefore omitted from my list.

Lastly, I follow Col. Beddome in separating *Polypodium simplex* from *Pol. lineare*. The former is a thin-fronded, eminently perishable fern which shrivels up and disappears with the first breath of the dry northerly wind. The latter is a thick coriaceous fern which simply rolls up its fronds at the end of the rains and waits till the damp air and rain of the following monsoon once more unrolls them and restores their torpid vitality. *P. clathratum*, Clarke, is a third allied, but quite distinct, species very abundant in Simla.

There are a few other changes that, as the result of my own experience in the field, I should be inclined to make, but I have refrained in deference to Mr. Clarke's wider knowledge.

It is much to be desired that botanists should agree to some general rule to regulate specific distinction in dealing with forms so variable and yet presenting so few marked characters as ferns. At present, the practice of different describers is by no means uniform, and that which each follows is generally to be gathered only by inference from the results of his work. The rule which I have formulated for my own guidance is that, when two sets of forms which can readily be distinguished apart occupy the same or contiguous areas (if as far as is known they are not linked by intermediate forms either in these areas or in the interval between them), they should be recognized as distinct species, and such distinction would not be invalidated by the existence of a form possessing intermediate characters in some far distant region. On such grounds I base the separation of *Cheilanthes Dalhousiæ* from *Cheilanthes farinosa*, and *Adiantum Edgeworthii* from *A. caudatum*.

I attach much importance too to marked differences of habit such as have been noticed above in the case of *Polypodium lineare* and *P. simplex* (in this case, however, the two forms have a different venation also). And especially when these are accompanied with equally marked differences in the characters of the habitat and the range of elevation of the contrasted forms. Thus *Asplenium tenuifrons* differs from *A. nigripes*, not only in the manner of its growth, and the form and texture of the frond, but it is restricted to levels below 7,000 feet and the immediate neighbourhood of streams; whereas *A. nigripes* grows on well shaded hill slopes, only at elevations above 8,000 feet. In all these cases no intermediate forms are met with.

The following is a numerical generic summary of the species and varieties enumerated in this list.

	Species.	Varieties.
Woodsia	1	
Dicksonia	1	
Trichomanes	1	
Davallia	3	1
Adiantum	6	
Cheilanthes	4	2
Onychium	1	1
Cryptogramme	1	
Pteris	5	
Woodwardia	1	
Asplenium	21	3
Aspidium	6	2
Nephrodium	7	4
Oleandra	1	
Polypodium	18	
Notholœna	1	
Gymnogramme	4	
Osmunda	2	
Ophioglossum	1	
Botrychium	3	
Total	88	13

List of Ferns collected in the Neighbourhood of Simla between the Levels of 4,500 *and* 10,500 *Feet.*

1. WOODSIA ELONGATA, Hook.

Common on Kumalhori and Hatu, above 9000 ft. At Baghi, at the eastern extremity of Hatu, it occurs as low as 8,500 ft.

2. DICKSONIA SCABRA, Wall.

Rare. Found only at 5,800 and 6,000 feet below Simla.

3. TRICHOMANES BIPUNCTATUM, Poir.

Not common. My highest is 6,500 feet. Also on damp rocks and trees below Simla at 5,500 and 5,800 ft.

4. DAVALLIA (LEUCOSTEGIA) IMMERSA, Wall.

Very rare. Mentioned in the 1877 list. The only specimen I have seen is a barren frond found by Col. Collett at 5,800 ft.

5. Davallia (Leucostegia) pulchra, Don. sp.

The typical form, distinguished by its red rachis, obtuse segments and ovate scales of the rhizome is abundant on trees on Kumalhori and Hatu above 8,500 ft., but does not occur lower.

6. Davallia pulchra, var. *pseudocystopteris*, Kunze sp.

Very abundant on trees at Simla between 5,500 and 8,000 ft. It is to be met with only in the rains, and blanches and shrivels up with the first northerly winds, about the beginning of September, except in damp ravines, where it lasts a few weeks later.

7. Davallia (Stenoloma) Chinensis, Swartz.

Rare. In two ravines below Chota Simla at about 5,000 ft. Clarke quotes it from Kumaon; but it is rare at Mussoorie.

8. Adiantum lunulatum, Burm.

At 4,500 ft. in the Sainal valley below Simla, but at no higher elevation. It ranges over the plains of India in damp places.

9. Adiantum caudatum, L.

Common in damp situations by streams from 5,000 ft. downwards. Abundant in the Doons and Sivaliks.

10. Adiantum Edgworthii, Hook.

Found in situations similar to the preceding, but at higher levels. It is not common, but I have gathered it in several ravines below Simla up to 6,000 ft.

11. Adiantum capillus Veneris, L.

Common on damp rocks by streams below 6,000 ft. In the arid climate of Beluchistan, it grows in the subterranean water-courses (termed *karezes*) used for irrigation.

12. Adiantum venustum, L.

One of the commonest and most abundant ferns of Simla, covering banks and sloping ground in shady places, and ranging from 4,500 ft. up to the top of Hatu at 10,500 ft.

It varies much in cutting, being either 2- or 4-pinnate. Also in the shape and size of the ultimate pinnules, which vary from narrowly

cuneate to rhomboidal and transversely elliptical, being broader than deep. Both series of forms occur throughout the range. The sori are generally orbicular reniform with a deeply notched margin; but sometimes oblong with a straight margin.

13. Adiantum pedatum, L.

Rare. I have found it only on the north face of Hatu, at elevations of 8,500 and 10,000 ft. This last is nearly 1,000 ft. higher than Clarke's and Beddome's highest assigned range.

14. Cheilanthes subvillosa, Hook.

Chiefly above 8,000 ft. But I have found stragglers as low as 7,300 ft. on Jako. It is common in the neighbourhood of Matiana and Nagkanda, on the bank by the roadside.

15. Cheilanthes Dalhousiæ, Hook.

Quite distinct from *C. farinosa*, and subject to little variation. Its range is from 7,800 ft. to the highest visited (10,500 ft.). Fine specimens are to be found on Jako, though not common. It is more abundant on Kumalhori and Hatu.

It appears to be restricted to the Himalaya, and is most abundant in the N. W. Himalaya. In Sikkim it appears to be rare, but Sir J. Hooker gathered it at 10,000 ft. on Lacheely, and Mr. Levinge found it growing plentifully on Sinchal close to Darjiling at 8,000 ft. He agrees with me as to its specific value. The following is a description of its distinctive characters.

Stipes 2 to 4 ins. long, shorter than the frond, naked or with a few lax spreading scales near the base. Fronds 6 to 9 inches long, 2 to 4 inches broad, acute lanceolate, without white powder at any stage of growth. Lower two pairs of pinnæ subequal. Segments narrow. Lines of sori interrupted at the sinus. Involucres even, crenate or toothed on the margin, hardly lacerate.

16. Cheilanthes albo-marginata, C. B. Clarke.

Very abundant in and around Simla, covering the roadside banks and old stone retaining walls. Range from 4,800 ft. (my lowest) up to 8,500 ft., above which it is replaced by *Ch. Dalhousiæ*. Like that species it appears to be restricted to the Himalaya and chiefly to the N. W. Himalaya, though I learn from Mr. Levinge that his native collector brought him a specimen from the interior of Sikkim. A *Cheilanthes* which occurs on the Khasi hills, also Mount Abu and the Nilgiris, and

has been referred to this species, is that which I describe below as *Ch. farinosa*, var. *anceps*. The following is a description of *C. albo-marginata*, which is well represented in the figure Plate 52 of Mr. Clarke's Review, except that the scaliness of the costæ and veins is not fully shown.

Stipes 4 to 10 ins. long, generally shorter than the frond, bearing throughout dark linear lanceolate scales with pale translucent margins. Similar scales extend to the primary and secondary rhachises and costæ. Fronds up to 11 inches long, acute deltoid, under surface naked or in the young state, and in the small fronds that persist through the dry season, thinly coated with yellowish white powder. Lowest pair of pinnæ generally the longest. Segments oblong. Lines of sori scarcely interrupted at the sinus. Margins of involucres highly lacerate.

It is always readily distinguishable from other allied forms by the presence of scales on the veins and costæ, and by the highly lacerate involucres.

17. Cheilanthes farinosa, Kaulf, var. *typica*.

This is very abundant in the Sivaliks and Doons and in the deeper valleys of the outer Himalaya up to 4,000 ft. In the neighbourhood of Simla, it may be found as high as 5,000 ft., above which I have not met with it. The following characters distinguish it from other allied forms.

Stipes up to 12 ins. long, generally longer than the frond, deep red brown, naked or with a few linear scales, near the base only. Frond deltoidly lanceolate, acute to acuminate, up to 8 ins. long and 5 ins. broad, always thickly coated beneath with white powder. Lowest pair of pinnæ always the longest. Segments narrow. Sori continuous round the sinus. Margins of involucres entire, uneven or toothed, not lacerate.

This form ranges all over India. I have collected it at Pachmari at 3,000 ft., and I have specimens from the Khasi hills at 3,000 and 5,000 ft., and from the Nilgiris up to 6,000 ft.

18. Cheilanthes farinosa, var. *anceps** nov.

This has been frequently confounded with *Ch. albomarginata*. It appears to have as wide a range in India as the typical variety. In the North-West Himalaya, it has a well defined, but restricted, range of elevation, *viz.*, from 3,500 to 6,000 ft, and is common below Simla between 4,500 and 5,000 ft. Its characters are as follow :—

* This was described as *C. anceps* in a paper entitled, 'The silver Ferns of Simla and their Allies, read before the Simla Natural History Society, June 25th, 1886.

Stipes thick up to 8 ins. long, little longer or shorter than the frond, dark chestnut to almost black, bearing, generally throughout, dark linear lanceolate scales, with pale margins, which often extend to the principal rachis, but not beyond. Frond lanceolate to oblong lanceolate. Under surface always thickly coated with white powder. Lowest two or more pairs of pinnæ subequal, rather distant. Involucres narrow, with toothed or lacerate margins.

Readily distinguished from the typical form by the shortness of the lowest pair of pinnæ, and the greater extension of the scales. In large well grown fronds, the lower three or four pairs of pinnæ are nearly equal, and the form of the frond approaches that of *Ch. subvillosa*. Specimens collected by Mr. Clarke in the Khasi hills present the same characters as those of the N.-W. Himalaya. I have specimens also from Mt. Abu, collected by Dr. King, and from the Nilgiris at 4,000 ft. and 6,000 ft., collected by Mr. Gamble.

19. Cheilanthes farinosa, var. *grisea** nov.

This is an alpine form which I have met with only between Nágkanda and Bághi at 8,300 to 8,500 ft. Mr. Gamble has collected it on Sinchal near Darjiling at 8,000 ft.

Stipes slender, 2 to 6 ins. long, light brown, naked or bearing a few thin brown and translucent lanceolate scales (not white margined) near the base. Fronds dimorphous. One form narrow lanceolate 4 to 5 ins. long, $1\frac{1}{2}$ to 2 ins. broad, thin papyraceous. Lower 3 or 4 pairs of pinnæ sub-equal distant. Under surface thickly coated, upper surface sprinkled with white powder. Segments narrow oblong. The other form ovate lanceolate. Pinnæ close, triangular. Lower two pairs equal. Both forms fertile. Involucres as in typical variety.

These last five forms of *Cheilanthes* form a natural group, probably descended from the same parent form. *C. Dalhousiæ* and *C. albomarginata* are sufficiently distinct to be regarded as species. The two last enumerated approach the typical form more nearly and may conveniently be treated as varieties. With respect to the dimorphism of var. *grisea*, it would appear that the typical variety sometimes shows a similar tendency, as Mr. Clarke has communicated to me specimens from Shillong which he has noted as var. *subdimorpha*.

20. Onychium Japonicum, Kunze.

The type form is very rare at Simla. It has been found near Mas-

* Originally described as *Cheil. grisea*, nob.

hobra at about 6,000 ft. I have gathered it also in the Ravi valley near Chamba, a hundred miles further to the north-west.

21. Onychium Japonicum, var. *multisecta*, F. Henderson.

This is one of the commonest Simla ferns, growing abundantly, on the ground, both in forest and on the open hill side. It has a creeping root-stock. Its range at Simla is from 6,000 to 9,000 ft.

22. Cryptogramme crispa, R. Br.

On rocks by the roadside between Nágkanda and Bághi at about 8,300 ft.

23. Pteris Cretica, L.

Very abundant in certain parts of Simla, especially on the Sutlej side of the spur, between 5,500 and 6,500 ft. It disappears above 8,000 ft.

24. Pteris longifolia, L.

This is a fern of the plains, abundant in and about Calcutta. I have found it below Simla at 4,800 ft., but this is above its ordinary range.

25. Pteris quadri-aurita, Retz.

Tolerably common in damp sheltered places up to 8,600 ft., which is a higher range than that given by Clarke and Beddome (7,000 ft.). The Simla form is pretty constant. It has 14 or 15 pairs of sub-opposite pinnæ; either the lowest only, or the lowest 3 or 4 pairs bipartite.

26. Pteris excelsa, Gaud.

Very rare. Apparently restricted to well shaded spots by the margin of streams. I have collected it in two places at 5,500 and 5,800 ft., but I have not met with it during the last four years, the original sites having been devastated by wood-cutters and cattle, or exhausted by collectors.

27. Pteris (Piesia) aquilina, L.

This world-wide fern occurs down to 5,500 ft. below Simla, and it ranges up to between 9,000 and 10,000 ft. Very common at 8,000 ft. along the Great Tibet Road.

28. WOODWARDIA RADICANS, Smith.

Common on steep, well shaded banks, close to streams, below 5,500 ft.

29. ASPLENIUM ENSIFORME, Wall.

Very rare. I have not met with it myself, but it is mentioned in the anonymous 1877 list, and was found last year by the late Col. Crookshank near Bághi at about 6,000 ft.

30. ASPLENIUM ALTERNANS, Wall.

Very common on rocks and stony banks from my lowest levels (4,500 ft.) up to about 8,000 ft. The largest fronds I have seen do not exceed 9 ins. in length, whereas I have specimens from Sikkim, where Clarke says it is rare, fully one foot long.

31. ASPLENIUM TRICHOMANES, L.

Also a very common fern. Found in situations similar to the preceding from 5,000 up to 9,000 ft.

32. ASPLENIUM LONGIFOLIUM, Don.

Found growing on rocks, by streams, in well shaded ravines below 6,000 ft. Clarke and Beddome give the range at 6,000 to 8,000 ft., but I have never met with it above 6,000 ft. It is nowhere a common fern.

33. ASPLENIUM UNILATERALE, Lamk., var. *udum*, Atkinson.

I know of only one locality near Simla for this fern, *viz.*, below the Chadwick falls at 5,800 ft. The normal form does not occur at Simla.

34. ASPLENIUM LACINIATUM, Don., var. *depauperata*, Clarke.

Not common. Found in the same localities as *A. longifolium* and in similar situations. Mr. Clarke describes this variety as having small fronds, and Col. Beddome thinks it is only a starved form. In general, the fronds are small, not exceeding 6 or 7 inches, including the stipe. But I have specimens, differing in no respect from these except in size, which are over 12 inches in length, equal to the average of the planicaule variety.

35. ASPLENIUM FONTANUM, Bernh., var. *exiguum*, Bedd.

Rare in the neighbourhood of Simla. I have found it on rocks at 6,800 ft. and 7,500 ft.

36. Asplenium varians, Hook. and Grev.

Not uncommon, but nowhere abundant. Ranges from 4,800 ft. up to 10,500, at which elevation it was gathered by Dr. Watt on the top of Hatu.

37. Asplenium (Athyrium) Atkinsoni, Clarke, var. *Andersoni*.

Abundant in certain places on Hatu and Kumalhori at elevations of 8,500 ft. and upwards. Grows on the ground under trees, not in thick shade.

38. Asplenium (Athyrium) thelypteroides, Michx.

Abundant about Nágkanda 18,500—9,500 ft, covering the hill-side in the forest with circular tufts of fronds from 2 to 3 ft. in length.

39. Asplenium (Athyrium) macrocarpum, Hook.

Very rare. I have never met with it myself. But it was collected last year by a Simla resident a little below the Simla bazar, I believe, about 7,000 ft. or rather lower.

40. Asplenium (Athyrium) macrocarpum, var. *Atkinsoni*, Hkr. & Bkr.

Also very rare. I have found it only at the Chadwick falls at 5,820 ft., and not at all during the last two or three years.

41. Asplenium (Athyrium) Schimperi, A. Br.

A. filix fœmina, var. *polyspora*, Clarke.

This species, hitherto known as such only from Africa, is identical with the fern described by Mr. Clarke under the above synonym, as identified with his type in the Kew herbarium. It is one of the commonest and most abundant of the Simla ferns in the rains. It covers the ground beneath the oak trees on Jako and Mashobra hill, and the more open glades of the Elysium spur, and it ranges from the bottom of the Jaru-ka-nál ravine (5,500 ft.) to the top of Hatu (10,500 ft.). It occurs also at Mussoorie, but I have seen no specimens from any place further east. Mr. Clarke gives its range as from Kumaon to Chumba.

Except in the width of the fronds, which vary from lanceolate to deltoid lanceolate, the characters are very constant. Large specimens from Nágkanda are 2-pinnate. It is readily distinguishable from other *Athyria* by the creeping root-stock, combined with large horse-shoe shaped sori, and by the basal portion of the stipe being of a deep purple

colour, with brown lanceolate scales. Also by the greatly reduced pair of basal pinnæ.

42. Asplenium (Athyrium) nigripes, Mett.

The typical form of this fern is common on the partially shaded banks and hill sides, on the northern face of Kumalhori and Hatu, at elevations between 8,000 and 9,500 ft., but not nearer Simla. There are rarely more than 2 or 3 fronds on the rhizome, and they are firm in texture and, in general, nearly as broad as long.

43. Asplenium (Athyrium) tenuifrons, Wall.

Mr. Clarke regards this as merely a form of *A. nigripes*. In this view I cannot agree with him; differing as it does so greatly in habit and habitat, while neither exhibits a great range of variation. It is restricted to well shaded ravines, growing in the beds of streams at elevations below 7,000 ft. The fronds, numbering 4 or 5 or more, form a circular tuft on the short erect rhizome. They vary in form from ovate lanceolate to acute lanceolate, and the width of my broadest specimen is less than half the length of the frond; in the narrowest it is less than one-fourth. The texture is thin and the upper surfaces of the partial rhachises and costæ bear long glandular filaments. The colour of the frond in the fresh state is bright green, forming a beautiful contrast with the delicate pink tint of the rhachis and stipe. It is no doubt near *A. Clarkei*, and apparently grows in similar situations, but the fronds are broader and never root at the ends.

44. Asplenium (Athyrium) filix fœmina, Bernh., var. *dentigera*, Clarke.

Abundant on the northern face of Hatu and Kumalhori between 8,500 and 10,000 ft. The fronds grow in a circular tuft from an erect rhizome, attaining a length of 2 or 3 feet.

45. A. filix fœmina, var. *retusa*, Decne., subvar. *elongata*, Clarke.

I name this form from Mr. Clarke's type in the Kew herbarium. Many of the sheets so marked by him are from the neighbourhood of Simla. This fern is abundant on Kumalhori above Matiána up to 10,000 ft. Also on the roadside between Theog and Martiána at 8,000 ft., growing chiefly in rock crevices. The stipes are densely tufted on a decumbent root-stock; the fronds generally drooping. In mode of growth and indeed in most of its characters, it differs so greatly from the preceding that it should, I think, be distinguished as a species.

46 ASPLENIUM (ATHYRIUM) PECTINATUM, Wall.

Not uncommon in damp ravines below 6,000 it. It has, as a rule, a creeping root-stock, but the stipes are sometimes, though rarely, tufted. The partial rhachises and costæ bear glandular filaments like *A. tenuifrons.* It ranges down to at least 4,500 ft., generally growing near streams, and I have found it as high as 6,000 ft., or 1,000 ft. higher than Clarke's highest assigned range.

47. ASPLENIUM (DIPLAZIUM) JAPONICUM, Thunb.

Rare. I have found it only at the Chadwick falls at 5,800 ft.

48. ASPLENIUM (DIPLAZIUM) TORRENTIUM, Clarke.

Plate XVI.

I give this on Mr. Clarke's authority, who identified my specimens with the remark that " they are *A. torrentium* exactly as we have it in Sikkim." For my own part, I had regarded it as merely a simple form of the next following species, growing in exactly the same situations. It is rare, as I have met with it twice only at elevations of 4,500 ft. and 5,800 ft.

49. ASPLENIUM (DIPLAZIUM) POLYPODIOIDES, Mett.

Among boulders in the beds of streams below 6,000 ft., a *Diplazium* with large bipinnate fronds is common in all the valleys around Simla. The caudex is not erect but decumbent with tufted stipes. My impression is, and always has been, that, despite some variation in the form of the segments and the length of the sori, they are all of one species. But Mr. Clarke, whose much wider experience gives him an authority to which I cannot pretend, has examined my collections with the result that, in addition to *A. torrentium* and *A. polypodioides, fere typica,* he identifies the two following.

50. ASPLENIUM (DIPLAZIUM) LATIFOLIUM, Don. var. *polymorpha,* Wall. sp.

Plate XVII.

From three localities varying from 4,500 ft. to 6,000 ft.

51. ASPLENIUM LATIFOLIUM, var. *frondosa,* Wall. sp.

Plate XVIII.

From two localities at 4,500 ft. and 5,500 ft. respectively.

52. ASPLENIUM (DIPLAZIUM) MULTICAUDATUM ? Wall.

This identification is open to some doubt. The only specimens I have were collected in 1877 and 1882, at elevations of 4,500 ft. and 5,000 ft., and are without rhizomes. Both Dr. King and Mr. Clarke are of opinion that they are probably this species, and it certainly occurs no farther off than at Mussoorie. I include it therefore provisionally in my list.

53. ASPIDIUM (POLYSTICHUM) AURICULATUM, L., var. *cæspitosa*, Wall.

Very rare within my limits of elevation and area, though Mr. Clarke gives its range as from 4,000 to 8,000 ft. I have found it but once at 4,800 ft.

54. ASPIDIUM (POLYSTICHUM) ILICIFOLIUM, Don.

I am very sceptical as to the claim of this fern to specific rank. It appears to me to be an alpine form of *A. aculeatum*, which grows on rocks, and graduates into var. *rufo-barbata*. I believe Mr. Clarke and Col. Beddome hold the same view. Very characteristic specimens of the simply pinnate form occur on the rocks about Nágkanda between 8,000 and 9,000 ft., and small specimens may occasionally be found at Mahasu nd Mashobra at about the same lower level. The bipinnate form, which forms the first step of the passage into *A. aculeatum*, is common at the same elevation.

55. ASPIDIUM (POLYSTICHUM) THOMSONI, Hook.

This is rather a rare fern. Col. Collett has collected it as low as 7,500 ft., and I have met with it myself at two or three localities from 8,000 to 10,000 ft.

56. ASPIDIUM (POLYSTICHUM) ACULEATUM, Swartz.

Common; ranging from the lowest to the highest level visited (4,500 to 10,500 ft.). The low level forms differ from the higher in having the stipe and rachis clothed with dark hair-like scales, without pales; whereas those above 8,000 ft. have thin pale linear scales sparely intermingled with dark brown pales.

57. ASPIDIUM (POLYSTICHUM) ACULEATUM, var. *lobata*, Hook.

At all levels, but not common.

58. ASPIDIUM ACULEATUM, var. *rufo-barbata*, Wall.

From 5,000 to 9,500 ft. Common from 6,000 to 8,000 ft.

59. ASPIDIUM (POLYSTICHUM) PRESCOTTIANUM, Wall.

Abundant on Hatu, growing in dense masses on the hill side between 9,500 and 10,500 ft.; associated with *A. filix fœmina*, var. *dentigera*; *N. filix mas*, var. *da Claytoniana*, &c.

60. ASPIDIUM (CYRTOMIUM) FALCATUM, Swartz, var. *caryotideum*, Wall.

Very rare. The one or two known localities are rocky ravines between 5,000 and 6,500 ft.

61. NEPHRODIUM (LASTREA) PROLIXUM, Baker.

Common in ravines below 6,000 ft. I include herewith the forms from Simla that have been referred to *N. canum*, the type of which is a specimen of unknown origin, grown at Kew and having submarginal sori.

62. NEPHRODIUM (LASTREA) FILIX MAS, Richd., var. *normalis*, Clarke.

One of the commonest ferns in and about Simla, in partially shaded spots, at all elevations above 5,000 ft. Above 8,000 ft., the stipe and rachis become more scaley, the pinnules more acute and deeply cut, the frond being sub-tripinnate. These are the forms referred by Mr. Clarke to *N rigidum*, but there is a complete passage from the simpler to the more compound forms. All have the under surface of a pale bluish tint, which distinguishes them from var. *marginata* at lower levels.

63. NEPHRODIUM FILIX MAS, var. *patentissima*, Wall. sp.

Only the small form mentioned in Mr. Clarke's review occurs in the neighbourhood of Simla, and this only at elevations above 8,000 ft. It is not uncommon about Nágkanda and on Hatu, and seems to pass into var. *fibrillosa*, to which, as pointed out by Col. Beddome, it is nearly allied.

64. NEPHRODIUM FILIX MAS, var. *fibrillosa*, Clarke.

Very abundant on Kumalhori and Hatu above 8,500 ft., ranging up to 10,500 at least.

65. NEPHRODIUM FILIX MAS, var. *Schimperiana*, Hochst, sp.

Rare below 7,000 ft., but very common, and in places abundant, between that and 9,000 ft. on Jako, Mashobra, and Mahasu hills, and along the Tibet Road about Matiána and Nágkánda, in situations similar to those of var. *normalis*. It attains a large size, fronds of 2 and 3 ft. being

not rare. I cannot agree with Col. Beddome in regarding this as passing into var. *marginata*. On the contrary, I should be inclined to regard it as specifically distinct from all varieties of *N. filix mas*.

66. NEPHRODIUM FILIX MAS, var. *marginata*, Wall.

Clarke gives the range of this fern as from 6,000 to 9,000 ft. At Simla, according to my experience, 6,000 ft. is the higher, not the lower limit, and all the bipinnate forms allied to *N. filix mas* that I have collected at higher elevations are those above referred to under var. *normalis*. The fern here referred to appears to be identical with the *N. elongatum* from Southern India. I have collected it in several valleys below Simla between 5,000 and 6,000 ft., and below Mussoorie and Dalhousie at about 5,000 ft., or rather lower. It is generally found in wooded ravines in the immediate neighbourhood of streams. It does not seem to me to be very near any variety of *N. filix mas*. It differs from the compound forms of var. *normalis* by its more herbaceous texture and darker colour, never having the pale bluish tint of the under surface so characteristic of that and other varieties of *N. filix mas*.

In the dry state, when much of its characteristic habit is lost, it bears some resemblance to the high level ferns referred by Mr. Clarke to *N. remotum*, but I cannot admit any close affinity. There is an interval of 2,500 ft. between the upper limit of the present form and the lower limit of *N. remotum*.. Although some specimens of the two resemble each other in shape, in general, those of var. *marginata* are broader and less oblong. Their texture is thicker and their cutting though similar in character is coarser and larger. *N. marginata* never bears the black scales which are abundant on the stipe and rhachis of *N. remotum*. The veins are more prominent and the sori less close to the midrib. Although these characters, thus stated in detail, are doubtless critical, taken all together they constitute a difference of habit which, in conjunction with the difference of range, seems to me to indicate specific distinction.

67. NEPHRODIUM (LASTREA) REMOTUM, Clarke.

I adopt Mr. Clarke's name for this fern, without implying acquiesence in the view that it is identical with the European prototype. The fern here referred to is common about Nágkanda at elevations between 8,300 ft. and 9,500 ft., but does not occur nearer Simla. It is a thin-textured fern, some of the characters of which have been noticed under the preceding.

68. NEPHRODIUM (LASTREA) CRENATUM, C. B. Clarke.

Clarke and Beddome assign to this species a range from 2,000 up to 7,000 ft. in the Himalaya. It is nowhere common within the limits here adopted. I have met with it as high as 7,500 ft.; otherwise only at the lowest levels visited. It is, however, common lower down on the hills between 3,000 and 4,000 ft. as in the Jumna valley, and below Chakrata, always growing in rock crevices.

69. NEPHRODIUM (LASTREA) BORYANUM, Hk. and Bk.

Not uncommon in well shaded ravines below 6,000 ft.

70. NEPRODIUM PARASITICUM, L.

Not met with above 5,000 ft.; but common in the deep valleys at 4,500 ft. and below. It is a glabrous form, producing fronds up to 3 ft. long.

71. NEPHRODIUM PENNIGERUM, Hook., var. *multilineata*, Clarke.

Mr. Clarke does not include the N.-W. Himalaya in the range of this species. It occurs, however, together with the preceding at the lowest levels visited below Simla, and I have it also from Mussoorie collected by Mr. C. W. Hope, and from below Chakrata.

72. OLEANDRA WALLICHII, Presl.

Not common, but locally abundant, growing on perpendicular rock faces between 5,500 and 6,000 ft.

73. POLYPODIUM (PHEGOPTERIS) ERUBESCENS, Wall.

On steep shady banks by streams at the bottom of some of the deep valleys below Simla, where it is pretty common. My highest elevation is about 5,500 ft.

74. POLYPODIUM (PHEGOPTERIS) AURICULATUM, Wall.

Very rare in the neighbourhood of Simla. I have met with it but once, *viz.*, in 1882 in the Sámal valley at 4,500 ft.

75. POLYPODIUM (PHEGOPTERIS) DISTANS, Dòn.

Common in ravines, down to my lowest level, and up to nearly 10,000 ft. At the former limit the fronds are small and narrow, with short, distant pinnæ and the root stock decumbent, hardly creeping.

Above 7,500 ft. the fronds grow to 3 and 4 feet in length broadly lanceolate and with close-set pinnæ 2 inches broad; the pinnæ cut down square to a winged rhachis; segments deeply pinnatifid. Some specimens of these latter have a creeping rhizome.

76. Polypodium (Phegopteris) dryopteris, L.

I have not met with this myself, but Dr. Watt collected it at Bághi at 9,000 ft.

77. Polypodium (Goniopteris) multilineatum, Wall.

Not uncommon in the Glen and some other wooded ravines below 6,000 ft. The pinnæ are narrow. It ranges nearly 1,000 ft. higher than Mr. Clarke's assigned upper limit (5,000 ft.).

78. Polypodium (Goniophlebium) amœnum, Wall.

Common in damp shady places on rocks and rocky banks, generally near streams; at all levels between 5,500 and 8,500 ft.

79. Polypodium (Goniophlebium) lachnobus, Wall.

Not very common. Found on trees and rocks in shady ravines below 6,000 ft.

80. Polypodium (Goniophlebium) microrhizoma, C. B. Clarke.

Very common in the rains on rocks and trees from 5,500 ft. up to 8,500 ft., which is about the limit of its range in the neighbourhood of Simla.

81. Polypodium (Niphobolus) fissum, Hk. and Bk.

Rare and found only at levels below 5,500 ft.

82. Polypodium (Drynaria) rivale, Nutt.

Locally abundant on the oaks on Jako at about 7,800 ft. Also on similar trees between Theog and Matiána at about 8,000 ft. Not common.

83. Polypodium (Phymatodes) lineare, Thunb.

Plate XIX.

This is a fern of comparatively the lower levels. It is common in the Glen at about 6,000 ft., and I have found stragglers up to about

6,500 ft., but not higher. The fronds are thick and coriaceous, and in dry weather roll up from the margins, and so remain for weeks or months; unrolling again, like *Niphobolus*, on the return of wet weather.

84. Polypodium (Phymatodes) simplex, Swartz.

Plate XX.

Very abundant on trees during the rains. The lowest limit of its range is rather above than below 6,000 ft., and I have gathered it up to 8,500 ft., but it is rare above 8,000 ft. The fronds last only as long as the rains, and they blanch, shrivel, and disappear in September. Their texture is thin, the venation distinct, and they are often crimpled at the edges. The rhizome is thicker than that of *P. lineare*, but the scales that clothe it, and those that cover the young sori, are similar to those of *P. lineare*. In the living state the two species are very different.

85. Polypodium (Phymatodes) clathratum, C. B. Clarke.

Plate XXI.

Quite distinct from both the preceding, though often growing with *P. simplex*. Its lower limit is about 7,000 ft., but it is abundant on the trees on the north side of Jako, a little above that level, and ranges up to at least 10,000 ft. on Kumalhori and Hatu. Like *P. simplex*, it is found only in the rains, and in texture and mode of growth much resembles that species. But it is readily distinguishable by its narrow linear fronds, the character of the venation, and the clathrate scales of the rhizome and the sori. The sori are small, frequently oblong, of a bright orange colour, and sometimes confluent. The scales of the sori disappear at an early stage. The stipes are generally shorter and the fronds longer and more linear than in the specimen figured by Mr. Clarke. It is very common at Simla, and Mr. Duthie has collected it in Kumaon.

86. Polypodium (Phymatodes) membranaceum, Don.

Occurring only in the immediate neighbourhood of streams in deep shady ravines up to about 5,000 ft. Not common.

87. Polypodium (Phymatodes) hastatum, Thunb.

Very rare. In fact, I know of only one locality for it, near Simla, a rock at 6,200 ft. in the neighbourhood of a waterfall.

88. Polypodium (Phymatodes) Stewartii, C. B. Clarke.

This is equally rare, and has been found at only one place near Simla, on rocks at an elevation of about 7,400 ft.

89. Polypodium (Phymatodes) malacodon, Hook.

Occurs only on Kumalhori and Hatu, near the summits of these hills, *viz.*, above 10,000 ft., but locally plentiful, growing on rocks.

90. Polypodium (Phymatodes) ebenipes, Hook.

Also found only on Kumalhori and Hatu, but down to lower levels. It occurs on rocks between Nágkanda and Bághi between 8,000 and 8,500 ft., and also on the top of Hatu, associated with the preceding species.

91. Notholoena marantæ, R. Br.

A high level fern and not common. I have gathered it as low as 8,300 ft., and it grows on the top of Hatu at 10,500 ft.

92. Gymnogramme (Leptogramme) aurita, Hk., var. *Levingii*, Clarke.

Abundant in some places at 8,000 ft. and upwards, in damp shady places, especially marshy spots, in the forest. In my opinion it should rank as a species distinct from *G. aurita*.

93. Gymnogramme (Syngramme) vestita, Hook.

The well known mouse-ear fern. Very common on rocks and on overhanging stony banks. Ranging from 6,000 up to 9,000 ft.

94. Gymnogramme (Syngramme) fraxinea, Bedd.

Common locally at all elevations from 5,000 up to 10,000 ft. growing on the ground in forest. Below 6,000 ft. it is bipinnate only as regards the lowest pair of pinnæ, and the pinnules are broad and large. Those from higher elevations have several pairs of pinnæ again pinnate and the pinnules are smaller and narrower. It is often 3-pinnate.

95. Gymnogramme (Selligneа) involuta, Hook.

Not common at Simla, and only found below 6,000 ft. on rocks in shady places by streams.

96. Osmunda Claytoniana, L.

Only on Hatu at about 10,000 ft. or higher. It unrolls its fertile

fronds in June, and in September fertile fronds may be hunted for in vain.

97. Osmunda regalis, L.

Very rare, and now nearly extirpated by assiduous collectors. Below 6,000 ft.

98. Ophioglossum vulgatum, L.

Rare. Found by Dr. Watt on Hatu between 8,000 and 9,000 ft. in July 1885. It has been found also at Mussoorie.

99. Botrychium lunaria, Swartz.

Equally rare. Found with the preceding by the same botanist and also on the slopes of Kumalhori near Nágkanda.

100. Botrychium daucifolium, Wall.

Rare. I have found it only on one hill within the limits of Simla, where it occurs, in glades in the forest, at an elevation a little below 7,000 ft.

101. Botrychium Virginianum, L., var. *lanuginosa*, Wall.

Rare, though less so than the preceding. I have gathered it at several places round Simla at elevations between 5,000 ft. and 6,800 ft.

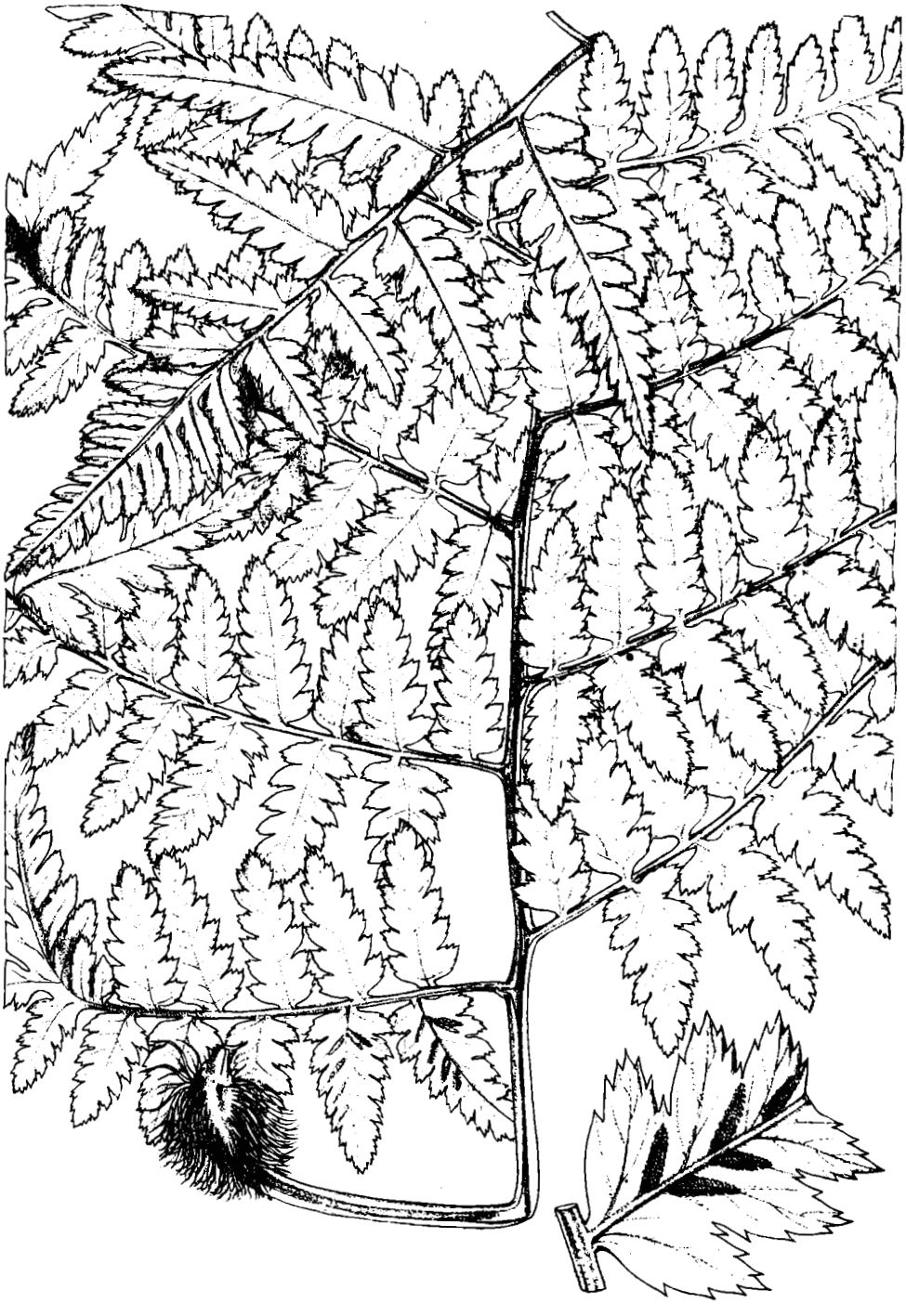
Chas. Fitch lith. West, Newman & C.ᵒ imp.

ASPLENIUM (DIPLAZIUM) TORRENTIUM. *C.B.Clarke*.

Chas. Fitch lith.

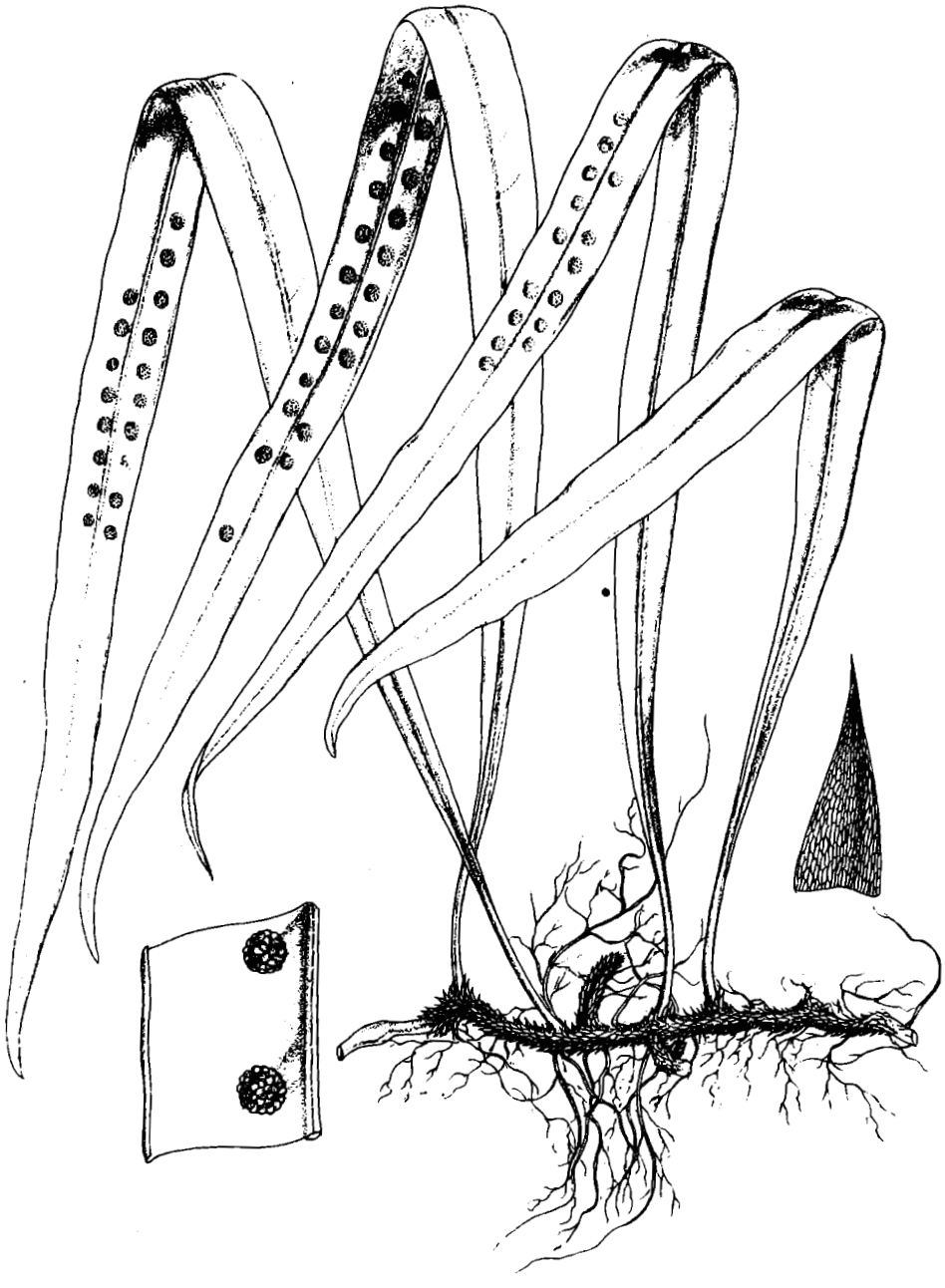
West, Newman & Co. imp.

ASPLENIUM (DIPLAZIUM) LATIFOLIUM. *Don.* var. POLYMORPHA. *Wall sp.*



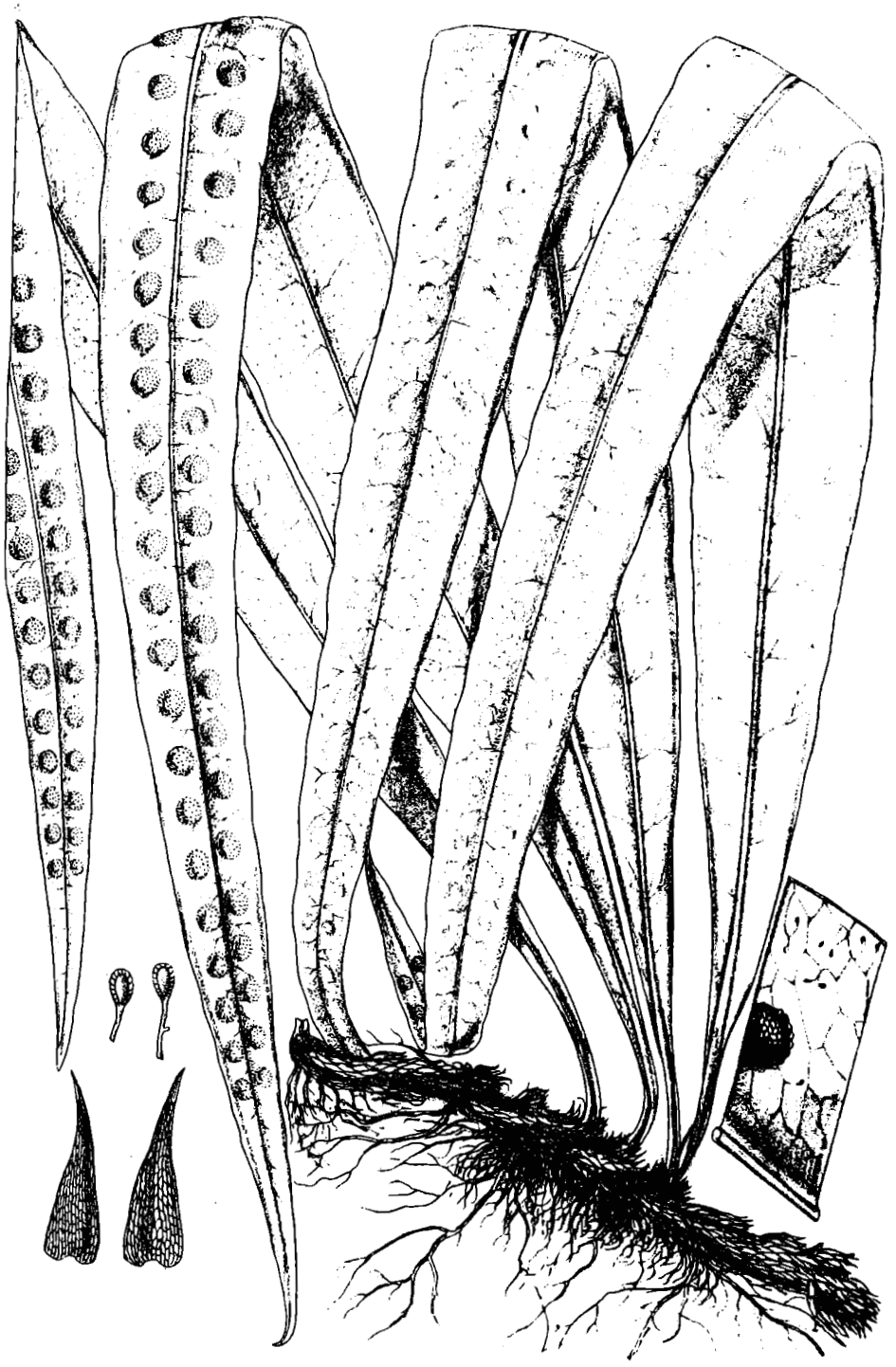
Chas Fitch. lith. West, Newman & Co imp

ASPLENIUM (DIPLAZIUM) LATIFOLIUM *D.Don.* var. FRONDOSA. *Wall.* sp.



Chas.E Fitch, lith. West, Newman & Co.imp

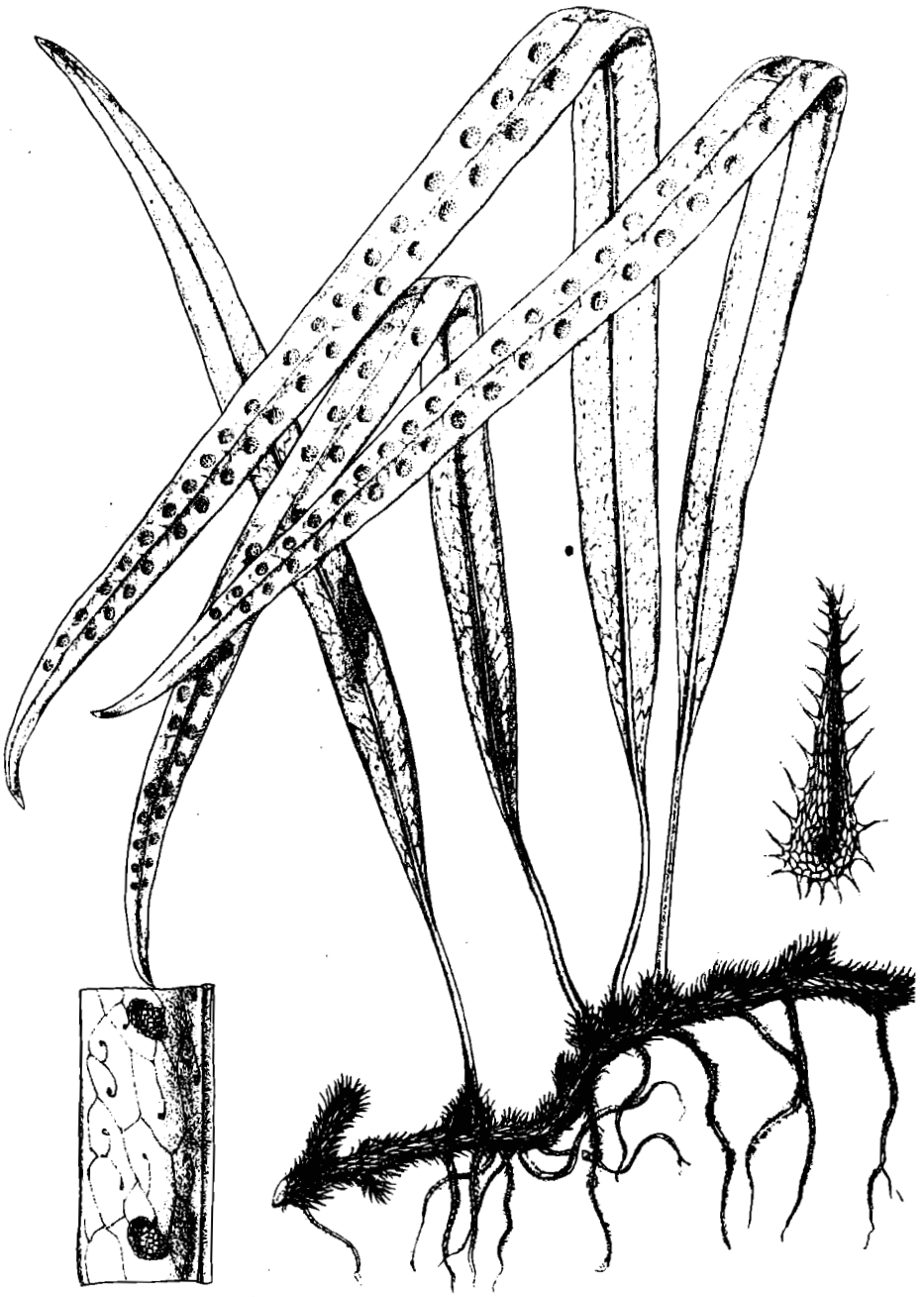
POLYPODIUM (PHYMATODES) LINEARE. *Thunb.*



Chas.ª Fitch, lith.

West, Newman & Co.ª imp.

POLYPODIUM (PHYMATODES) SIMPLEX. *Swartz.*



Chas. Fitch lith. West, Newman & Co.° imp.

POLYPODIUM (PHYMATODES) CLATHRATUM. *Clarke.*