

VIII. *Descriptions of two new Genera of the Natural Family of Plants called Coniferæ.* By DAVID DON, Esq., Libr. L.S., Prof. Bot. King's College.

Read April 17th, 1838.

THE *Coniferæ* undoubtedly constitute one of the most interesting families in the vegetable kingdom, whether considered in connexion with the former vegetation of the earth, or in reference to their peculiarities of structure, or as objects of utility, affording to man an abundant supply of valuable materials employed extensively in the arts and domestic œconomy. Their habit and structure are so peculiar that they have been ranked as a separate family by the earliest writers on Systematic Botany. Richard in his valuable work, “Mémoires sur les Conifères et les Cycadées,” has distributed the family into three groups, denominated by him, from the typical genera of each, *Abietinæ*, *Cupressinæ*, and *Taxinæ*; the first may be characterized by their female spikes forming a cone or strobilus, their ovula being in pairs, and by their scaly buds; the second by their reproductive organs having a tendency to become indefinite, by their naked buds, and other peculiarities of habit; the third by their female spike being usually reduced to a single flower, with a solitary, completely naked ovulum, whose external integument assumes a fleshy consistence and resembles an arillus. All three will be found to correspond remarkably in the structure of their male flowers; and the differences presented by their female inflorescence are more apparent than real, for they consist rather in the degree of reduction of parts than in actual structure. Their organs of nutrition present a remarkable degree of uniformity in their structure, and, indeed, it would be difficult to point out a family so completely natural, and one whose groups pass so insensibly into each other.

To the three groups above mentioned I propose to add a fourth, which may be named *Araucarineæ*, and to consist of *Araucaria*, *Dammara*, and perhaps *Cunninghamia*, which correspond with *Cupressinæ* in the tendency of their reproductive organs to become indefinite, in their naked buds, and in their general habit. This group being mutually related to *Abietinæ* and *Cupressinæ*, would

hold an intermediate station between them. Their indefinite thecæ, varying from 3 to 20, and their naked buds, will distinguish them from *Abietinæ*, while their fewer ovula, deciduous pericarpia, and strobiliform female spike will separate them from *Cupressinæ*. The species of *Araucaria* naturally separate themselves into two groups, characterized by peculiarities of habit and structure, as well as by their geographical distribution. The three Polynesian species having four cotyledons, and presenting a difference in the position of the leaves in the young and adult plants, have also fewer thecæ, and the crests of the anthers are short and closely imbricated; while the two South American species present no difference in the position of the leaves in the immature and adult plants; the crests of the anthers are elongated and squarrose, and the thecæ double the number. The Chilian *Araucaria imbricata* extends along the Cordilleras of the Andes from the 35° to about the 50° of S. latitude, while the Brazilian species occurs in the provinces of Rio de Janeiro and Minas Geraes between the 15° and 25° of S. latitude. The *Araucaria excelsa* appears to be exclusively confined to Norfolk Island, and the *Cunninghamii* to the east coast of New Holland, between the 14° and 30° of S. latitude; the other species (*A. Cookii*, Br.) is limited to New Caledonia and some small islands adjacent; and it is not improbable that the interior of New Guinea or Borneo may afford a fourth species of the same group, which, if it does not possess characters sufficiently important to rank as a distinct genus, it at least constitutes a very marked section, for which Salisbury's name of *Eutassa* may be retained. The Polynesian species are remarkable for having the vessels of their fibrous tissue furnished on the sides parallel to the medullary rays with two or three rows of closely approximated and alternating dots having a hexagonal outline; nor am I aware whether this peculiarity extends to the South American species, and to the genera *Cunninghamia* and *Dammara*, a point which I hope soon to be able to ascertain\*.

\* Having recently had an opportunity of examining the wood of *Araucaria imbricata* and *brasiliensis*, and also of *Dammara orientalis*, I am now enabled to set this question at rest. The vessels composing their fibrous tissue present the same structure, having one or two rows of closely approximated dots with usually an angular outline, which, however, is not so regularly hexagonal as in *Araucaria excelsa* and *Cunninghamii*, from the circumstance of the dots being often in a single series, but when they happen to be arranged in two rows they are always alternate. The vessels of *Cunninghamia sinensis* have the dots in single rows, with a circular outline, but they are smaller and more numerous than in *Pinus*.

The work of Richard already mentioned, although of great value in a systematic point of view, threw comparatively little additional light upon the organization of this remarkable family of plants, from the circumstance of its learned author having either misunderstood or wholly overlooked many parts of their structure. We are indebted to Mr. Brown for having first pointed out the real nature of the parts of the female flower in this family. Richard, as is well known, adopted in a great measure the views of preceding botanists. He regarded the expanded pericarpia as bractes, the ovula as the flowers, the integument as the calyx, and the apex of the nucleus as the stigma, and the fleshy outer integument of the ovulum of *Taxus* (which is developed after fecundation) as a kind of involucre. He moreover describes the flowers as inverted in *Abietinæ*, and erect in *Cupressinæ* and *Taxinæ*, and he considered the ovulum (nucleus) to follow the direction of the flowers. The two genera, which form the subject of this communication, belong to the *Cupressinæ*, a group distinguished, as I have before stated, by the tendency of their reproductive organs to become indefinite, by their persistent pericarpia, naked buds, and other peculiarities of habit. To his character of the group Richard added the form of the mature female spike, which is usually a galbulus, composed of peltate scales; but in the two genera which I am about to describe, that organ has assumed nearly the form of a cone, as in *Pinus*. The genera comprised in the *Cupressinæ* are *Cupressus*, *Thuja*, *Callitris*, *Taxodium*, *Juniperus*, and the subjects of the present paper. The structure of the fruit of *Juniperus* differs only from *Cupressus*, in the peltate scales becoming confluent and fleshy as the fruit advances towards maturity. This will be best understood by examining the female spike at an early stage, when it is scarcely possible to distinguish between the two genera. From its fleshy fruit some have supposed that *Juniperus* was related to *Taxus*; but that is a mere point of analogy, for in *Juniperus* the flowers and ovula are indefinite, and the scales or pericarpia unite and become fleshy, while in *Taxus* the female spike is reduced to a single flower, with a solitary, completely naked ovulum, whose outer integument becomes succulent, and altogether resembles a fleshy arillus.

The species of this group are pretty equally distributed in both hemispheres; but none of the genera are strictly confined to either, with the exception of *Taxodium* and *Cryptomeria* to the northern, and *Athrotaxis* to the southern,

hemisphere. A species of *Juniperus* occurs at Cape Horn, and one species of *Thuja* in Chile, and another at the Straits of Magellan; while *Callitris*, a genus containing more than twenty species natives of New Holland and Van Diemen's Land, has a solitary species on Mount Atlas in 35° North latitude.

### CRYPTOMERIA.

Ord. Nat. CONIFERÆ. *Linn. Juss.*

Trib. II. CUPRESSINÆ. *Rich.*

#### *Character Essentialis.*

*Amenta mascula* spicata. *Squamæ antheriferae* rotundatae, adpressè imbricatae, sessiles. *Antherarum thecae* 5, connatae! basi squamarum omninò adnatae, anticè foramine amplo dehiscentes. *Strobili* solitarii, globosi, squarrosi: *squamis* è pericarpio 3—6-dentato bracteâque lanceolatâ acuminatâ infernè concretis compositis. *Semina* 4 v. 5, erecta, inæquilateri-oblonga, margine angustè alata.

#### *Character Generalis.*

FLORES monoici.

MASC. *Amenta* plurima, ovato-oblonga, obtusa, sessilia, bracteata, unguicularia, in spicam terminalem vix uncialem aggregata. *Bracteae* subulatæ, rigidæ, patulæ, amento parùm breviores. *Squamæ antheriferae* sessiles, brevissimæ, rotundatae, undique adpressè imbricatae, ferrugineæ, hinc convexæ, lævissimæ, margine angustè membranaceæ; extimæ obsoletè carinatae, subapiculatæ. *Antherarum thecae* 5, rariùs 4 v. 6, brevissimæ, uniloculares, turgidæ, inter se connatae, basi squamarum omninò adnatae, anticè foramine amplo dehiscentes. *Pollen* è cellulis globosis lævibus compositum, pulverem sulphureum æmulans.

FÆM. *Amenta* in ramulorum apice terminalia, solitaria, sessilia, globosa, multiflora: *squamis* è pericarpio 3—6-dentato bracteâque lanceolatâ acuminatâ infernè concretis compositis, crassis, coriaceis, rigidis, unguiculatis, regione placentiferâ dilatâtâ, fungosâ, vix protuberanti: *ungue* 2 lineas longo, verticalitè compresso, hinc obtusè elevato-carinato, inde rectiusculo, convexo, sulcato. *Ovula* 4 v. 5, erecta, atropa, ovata, compressa, verticalia, invicem se subimbricata, margine angustè alata,

angulo interiore curvato margine latiore, exteriore rectiusculo parùm angulato, basi hilo oblongo, apice foramine obliquè terminali, tubuloso, ore orbiculato aperto instructa: *integumento* simplici. *Strobili* subrotundi, squarrosi, muricati. *Pericarpium* è foliorum verticillo? infernè conferruminato, simulque bracteâ concreto, supernè soluto in dentibus 6, rariùs 3—5, subulatis, compressis, sulcatis, rigidis, apice mucronatis, recurvis compositum. *Bracteæ* pericarpium longitudine, eodemque infernè accretæ, ovato-lanceolatæ, acuminatæ, subcarinatæ, apice libero recurvato. *Semina* 4 v. 5, inæquilateri-oblonga, compressa, collateralia, fusco-badia, margine angustè alata, hinc curvata, inde rectiuscula et parùm angulata: *testâ* crustaceâ: *albumen* carnosum, parcius. *Embryo* teres: *cotyledones* 2: *radicula* conica, brevissima, supera.

Arbor (japonica) *procera, sempervirens*. Truncus *rectissimus, crassitie pedalis*. Lignum *album, densè compactum: contextûs fibrosi vasa tenuissima, punctis minutis orbiculatis simplici ordine crebrè notata*. Ramuli *patuli*. Folia *ferè omninò Araucariæ Cunninghamii, 5-fariàm ordinata, subulata, rigida, viridia, verticalitèr compressa, 4-sulcata, incurva, vix pollicaria, apice calloso obtusiuscula, basi in angulum carinatum decurrentia; adultiora persistentia; novella præsertim ad ramulorum basin abbreviata, subimbricata*. Amenta mascula *aggregata; foeminea solitaria*. Antherarum thecæ *flavæ*. Strobili *subrotundi, vix juglandis magnitudine*.

TAB. XIII. Fig. 1.

1. C. japonica.

Cupressus japonica. *Linn. Fil. Suppl.* 421. *Thunb. Jap.* 265. *Willd. Sp. Pl. vol. iv.* 513. *Gærtn. Fruct. vol. ii. t.* 91. *Lam. Dict. vol. ii.* 244. *Ill. t.* 787. *f.* 2.

San, *vulgò* Ssugi. *Kæmpf. Amæn.* 883.

*Habitat* in Insulâ Nipponiæ, et in montibus circa Nagasaki urbem spontè vulgaris. *Kæmpfer, Thunberg.* 2. (v. s. spont. à Thunbergio ipso communicatum in *Herb. Linn. Fil.* nunc in *Mus. Soc. Linn.*).

The present genus is one of great interest in a botanical point of view from the peculiarities of structure of its reproductive organs, as well as from its remarkable habit, which is so like that of *Araucaria* or *Eutassa Cunninghamii*,

that a branch of the one might readily be mistaken for that of the other. The leaves are evergreen, subulate, laterally compressed, and in other respects they closely resemble those of that plant. The structure of the reproductive organs is even more remarkable than in any other of the *Cupressineæ*. The male catkins, which in the other genera of that group are terminal and solitary, are here numerous, as in the normal tribe of *Pinus*, and crowded in a spike-like manner at the extremity of the branches. They are short, and the antheriferous scales are crowded, sessile, and closely imbricated, as in *Araucaria excelsa* and *Cunninghamii*. The thecæ, 5 in number, are unilocular, very short, combined together in a single series, concealed at the base of the scales, and open inwardly towards the axis by a large rounded aperture. The female spikes are solitary and borne on the same tree, and most frequently on the same branch, in which case they occur on the inferior branchlets. They are globular, squarrose, and about the size of a walnut. The most remarkable peculiarity of the genus, however, is that the composition of the male inflorescence seems to be reproduced in the female, the pericarpium apparently consisting of a verticil of leaves combined together, and concrete with the bracte, which is here much developed; the points of the pericarpial leaves, together with the upper portion of the bracte, are free, and crown the mature fruit in the form of subulate recurved teeth. The ovula vary from 4 to 5, and appear to bear some relation to the divisions of the pericarpium by which they are concealed. The more complex structure of this genus appears to militate against the view taken by Dr. Schleiden of the female flower of *Abietineæ* in his interesting memoir on the vegetable ovulum, of which a translation is given in that valuable periodical, the "Philosophical Magazine and Journal of Science," for February and March last. According to him, the ovula in all cases originate from the axis, of which the placenta is a modified portion; and he regards the scale, or what I have described as an expanded pericarpium, in *Abietineæ*, as, in reality, the placenta, and what has hitherto been regarded as the bracte as the true pericarpial leaf. This opinion he founds upon an examination of a monstrous spike of *Abies alba*, which upon the upper half bore female, and upon the lower half male, flowers, and he refers to an unpublished work of his for further details. With the very brief notice given in the memoir above-mentioned, and in the absence of the proofs which are to be adduced by

Dr. Schleiden in support of his theory, it would be premature to enter into a full discussion of the subject upon this occasion ; but whatever may prove to be the case in *Abietinæ*, we must, I think, admit that the remarkable organ in the present genus is really a pericarpium. In *Pinus* (*Picea*) *bracteata*, for example, these supposed pericarpia do not differ from the ordinary leaves ; and in some other species the transition from them to leaves is imperceptible, the exterior ones being in most cases barren. The supposed placentæ present a foliaceous character in *Abies* and *Larix*, and in the Silver Firs, where the leaves are petiolate, the scales are constantly stipitate, and in all cases they follow the arrangement of the foliaceous organs, which, I think, would not be so uniformly the case were they portions of the axis, and not modifications of the leaves. This is beautifully shown in the following genus *Athrotaxis*, where the female spike presents all the appearance of a young branch.

In *Cunninghamia* and *Araucaria* we have only one organ present, which is clearly derived from the leaf, and which performs the office of the supposed placenta in *Pinus*, in the former genus bearing several ovula, and in *Araucaria* one only, with which it becomes confluent. The existence of a single floral envelope in these two genera may be accounted for either by supposing that the bracte and pericarpial leaf become confluent at an early period, or that what I have described as the bracte and pericarpium may constitute in all cases but one organ, the scale being merely the enlarged base of the pericarpial leaf ; a view which would gain some support from the change which takes place in the leaves of diseased branches of the spruce fir. Pavon, in his memoir on *Araucaria imbricata*, describes and figures the free extremities of the pericarpial leaf and the wing of the ovulum, which are readily distinguishable in the young state, as a bivalved stigma.

Perhaps the genus *Callitris* of all others affords the most convincing proof of the origin of the supposed placentæ ; for in the different species of that genus we uniformly find them regulated by the number of leaves in a verticil, which consists of three or four.

All these circumstances appear to confirm the accuracy of the view taken by Mr. Brown\* that the scales are expanded pericarpia ; and it seems more

\* In justice, however, to this learned botanist, I ought to state that he was the first to suggest the very theory adopted by Dr. Schleiden as to the nature of the supposed pericarpia.—See Appendix to Capt. King's Voyage, vol. ii. p. 560.

natural to consider the placenta as forming a part only, than that it should constitute the whole of what we regard as the pericarpium.

The circumstance of buds being developed upon leaves is by no means so rare an occurrence as Dr. Schleiden supposes; for not only *Bryophyllum*, but *Kalanchoe*, *Rochea*, *Echeveria*, and other genera of *Crassulaceæ*, are well known to be readily propagated by their leaves, which give birth to buds, and where care has been taken to cut them off above the point of insertion, so as to avoid the possibility of any portion of the axis adhering to them. The segments of the leaves of *Cardamine pratensis* and *amara* separate from the mid-rib in autumn, take root, and give birth to a young plant. In the autumn of 1836, while walking round the gardens of the Marquis of Ailesbury at Tottenham Park, Wilts, I was much gratified by observing a number of plants of a variety of the common Cabbage (*Brassica oleracea*) having their leaves covered with innumerable buds on the upper surface along the costæ and veins. The petiole and lamina of such leaves in other respects presented the ordinary appearance. But the most convincing proof of the origin of ovula from the carpellary leaves is afforded by a singular variety of the common Wallflower (*Cheiranthus Cheiri*), first observed by Mr. Brown, in which the stamina are converted into open confluent carpels, which bear ovula at their margins\*. These facts go clearly to prove the correctness of the opinion which derives the ovula from the carpellary leaves; and I am disposed to think that the case of the Yew (*Taxus*), singular as it is, will not be found to be an exception to the general law. I might also notice the female inflorescence of *Cycas*, which is clearly a modified frond, although I am aware that the mode of evolution of the fronds in that genus might be objected to their being leaves.

The wood in *Cryptomeria* is compact, and the fibrous tissue is composed of very slender vessels, united generally by their truncated ends, and furnished

\* Mr. Brown, who has studied with great attention and success the various changes and deviations which take place in the organs of plants, had the kindness to show me a series of beautiful drawings of singularly instructive monstrosities, in some of which one half of the anther was seen to bear ovula at its margin, while the other lobe remained in the ordinary condition, and contained pollen, the filament being entirely unchanged, and showing clearly that no part of the axis was present.—See Linn. Trans. vol. xii. p. 90., and vol. xiii. p. 212, where these drawings are referred to by Mr. Brown.



on the sides parallel to the medullary rays with a single row of minute dots, with a circular outline, much smaller and more crowded than in *Pinus*. These characters agree with the *Cupressineæ*, and differ entirely from the fibrous tissue of *Araucaria Cunninghamii*, the vessels of which are furnished with two or three rows of dots having a hexagonal outline; a peculiarity attributable to pressure, and arising, doubtless, from their close contact prior to the full growth of the membrane composing the vessel.

The specimen from which my description of this remarkable tree was taken, is contained in the extensive collections of the Society. It formed part of the Herbarium of the younger Linnæus, having been communicated to him by his friend and successor Thunberg on his return from Japan, and it was afterwards incorporated with the collection of our late distinguished President and Founder Sir J. E. Smith.

The concealed position of the reproductive organs has suggested the generic name, which is derived from κρυπτος, *occultus*, and μέρος, *pars*.

### ATHROTAXIS.

Ord. Nat. CONIFERÆ. Linn. Juss.

Trib. II. CUPRESSINEÆ. Rich.

#### *Character Essentialis.*

*Amenta mascula* solitaria, multiflora, capitata, laxa. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatae. *Antherarum thecæ* 2, distantes, divaricato-patentes. *Strobili squamæ* indefinitæ, lanceolatae, acutæ, regione seminiferâ incrassatâ. *Semina* 2 v. 3, compressa, pendula! margine altero alato.

#### *Character Generalis.*

FLORES monoici.

MASC. *Amenta* terminalia, solitaria, sessilia, capitata, rhachide brevissimâ subulatâ, squamis pluribus membranaceis involucrata. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatae, laxæ: *ungue* lineari-angustissimo, compresso: *limbo* oblongo, membranaceo. *Antherarum thecæ* 2, ovato-oblongæ, obtusæ, uniloculares, è baseos angulis squamarum limbi ortum

ducentes, oppositè distantes, ferè omninò liberæ, divaricato-patentes, ad peripheriam inferam rimâ bivalvi dehiscentes: *valvulis* convexis, cum ipsius squamæ substantiâ continuis.

Fœm. *Amenta* subrotundo-ovata, multiflora, sessilia: *squamis* è pericarpio bracteâque conferruminatis? compositis, indefinitis, ovato-lanceolatis, acutis, planiusculis, coriaceis, imbricatis, regione placentiferâ protuberanti. *Ovula* 3, atropa, obcordata, complanata, spadicea, à basi propriâ pendula! hilo obliquo transversè oblongo depresso badio placentæ adnata, margine membranaceo-alata, apice foramine brevissimè tubuloso brunnescenti, ore aperto æquali prominulo instructa: *integumento* simplici. *Strobili* subrotundo-ovati: *squamis* crassioribus, lignosis, stipitatis, stipite crasso subtetragono, regione seminiferâ valdè incrassatâ, apice ovato acuto coriaceo incumbente. *Semina* 3, v. sæpiùs tertio abortiente 2, ferruginea, margine altero (exteriore) dilatato alato, altero rectiore vix alato: *ald* è testæ epidermide tantùm constitutâ: *testa* tenuis, crustacea.

Arbusculæ (tasmanienses) *sempervirentes facie Lycopodiorum, foliis imbricatis, amentis terminalibus solitariis sessilibus.*

*Obs.* Genus à Cupresso facilè distinguitur amentis masculis laxis capitatis, squamis antheriferis longè unguiculatis subfastigiatis, antherarum thecis 2 divaricatis, strobili squamis planiusculis acutis, seminibus pendulis alatis.

1. *A. selaginoides*, foliis lanceolatis acuminatis laxè 5-fariàm imbricatis, squamis antheriferis acutis.

#### TAB. XIV.

*Habitat* in Tasmaniæ montibus prope Launceston. *D. Gunn.* (n. 368.) 2. (v. s. sp. in Herb. Lindl.).

*Arbuscula*, ut videtur, depressa, sempervirens, trichotomè v. rariùs dichotomè ramosissima. *Truncus* et *rami adultiores* infernè basibus foliorum adnatis persistentibus subquadratis parùm elevatis undique muniti. *Lignum* album, compactum; contextûs fibrosi vasa tenuissima, extremitatibus plerumque truncatis applicata, punctorum singulo ordine in utroque latere tubi parietum notata; puncta hæc sunt parva, orbiculata. *Ramuli* breves, conferti, densissimè foliosi. *Folia* undique conferta, laxè 5-fariàm imbricata, spirali modo disposita, lanceolata, acuminato-mucronata, incurvata, coriacea, rigida, vix semipollicaria, suprâ plana,

subtùs (extùs) convexa, obsoletè carinata, lævissima, nitida, viridia, margine pallidiori calloso integerrimo, basi dilatatâ decurrenti adnata. *Flores* in ramulorum apice terminales, capitati, monoici. *Amenta mascula* solitaria, sessilia, multiflora, laxa, foliis immutatis, squamisque (foliis mutatis) oblongis, obtusis, concavis, tenuissimè serrulatis, fulvis, conniventibus, margine scariosis involucrata: *axi* brevissimo, subulato, squamarum stipitum basibus persistentibus scabro. *Squamæ antheriferæ* longè unguiculatæ, subfastigiatae: *ungue* lineari-angustissimo, compresso: *limbo* ovato-lanceolato, mucronulato, membranaceo, concavo, fulvo, margine scarioso. *Antherarum thecæ* 2, e baseos angulis squamarum limbi ortum ducentes, ovato-oblongæ, obtusæ, oppositè distantes, divaricato-patentes, ad periphæriam inferam rimâ bivalvi dehiscentibus: *valvulis* cum squamæ ipsius substantiâ continuis. *Amenta fæminea* solitaria, sessilia, multiflora, subrotundo-conica: *squamis* e pericarpio bracteâque conferruminatis: compositis, indefinitè numerosis, ovato-lanceolatis, acutis, planiusculis, coriaceis, imbricatis, regione placentiferâ protuberanti. *Ovula* 3, atropa, obcordata, complanata, spadicea, margine membranaceo-alata, apice foramine brevissimè tubuloso brunnescenti, ore aperto æquali prominulo instructa: *integumento* simplici. *Strobili* subrotundi, juglandis minoris magnitudine: *squamis* crassioribus, lignosis, haud peltatis, stipitatis, stipite crasso subtetragono, regione seminiferâ valdè incrassatâ, apice ovato, acuto, coriaceo, incumbente. *Semina* 3, v. sæpiùs tertio abortiente 2, ferruginea, margine altero (exteriore) dilatato alato, altero rectiore vix alato: *alæ* e testæ epidermide tantùm constitutâ: *testa* tenuis, crustacea.

2. *A. cupressoides*, foliis ovatis obtusis adpressè 4-fariâ imbricatis, squamis antheriferis ellipticis obtusis.

TAB. XIII. Fig. 2.

*Habitat* in Tasmaniâ prope Launceston. *D. Gunn.* (n. 365 et 369). ♀. (v. s. sp. in Herb. Lindl.).

*Arbuscula* erecta, ramosissima, sempervirens. *Lignum* ut in præcedente, nisi quòd vasa quandoque duplici ordine punctorum notata. *Rami* conferti, cylindracei, facie *Cupressi torulosæ*, sed triplò crassiores. *Folia* creber-

rima, parva, adpressè 4-fariàm imbricata, ovata, obtusa, coriacea, lævis-sima, nitida, viridia, 1—2 lineas longa, hinc obsoletè carinata, inde concava, basi latâ adhærentia, margine perangusto scarioso. *Amenta mascula* in ramulorum apice solitaria, sessilia, laxè capitata, basi squamis (foliis mutatis) pluribus, oblongis, obtusissimis, inde concavis, margine scarioso-membranaceis involucrata. *Squamæ antheriferæ* pauciores et majores, ellipticæ, obtusæ, inde concavæ, rufescentes, margine membranaceæ: *ungue* angustè lineari, compresso. *Antherarum thecæ* 2, ovatæ, obtusæ, ad periphæriam inferam rimâ bivalvi dehiscentes. *Amenta feminea* subrotundo-ovata, omninò ut in præcedente, sed squamæ pauciores et paullò latiores. *Strobili* duplò minores, subrotundi: *squamis* cuneato-lanceolatis, lignosis, stipitatis, regione placentiferâ maximè protuberanti, quasi subpeltatâ, trigonâ, superficie inæquali: *stipite* compresso-tetragono: *apice* triangulari-ovato, acuto, incumbenti.

The habit of this singular genus recalls to mind the *Lepidodendra*, those forms which at present exist only in a fossil state; the axis is studded with the persistent adherent bases of the leaves, resembling the lozenge-shaped marks on the stem of the fossil genus above-mentioned, and the ramification frequently presents a dichotomous appearance, which arises from the nondevelopment of one of the lateral branches, the normal arrangement being a primary axis with two opposite lateral branches. The bases of the leaves of *Lycopodiaceæ* being so completely continuous with the axis would not present such marks as those mentioned, and I am therefore inclined to consider *Lepidodendron* as allied rather to *Coniferæ* than to that family, and the interesting genus above described appears to present us with an evident link of connexion. I have not had an opportunity of examining the internal structure of *Lepidodendron*, but it is a subject well deserving investigation to ascertain whether the vessels composing its woody tissue present that uniformity and dotting which prevail throughout *Coniferæ*.

The female spike in *Athrotaxis*, unlike that of most of the other genera of *Cupressinæ*, forms a regular strobilus as in *Pinus*, and the scales are very thick, woody and persistent, as in the normal group of that genus. I have assumed that they are composed of a bracte and pericarpium, which are here completely

concrete, and by a comparison with the proper leaves, I think there can remain no doubt of their origin. The apex of the supposed concrete bracte is free, and in the mature cone overlaps the summit of the placentary region, which is situated on the inner surface of the scale, near its apex, and which at that period is found greatly enlarged. The rapid enlargement of the placentary region prevents the ovula, which are always situated on its under side, from assuming an erect position, and they are consequently obliged to take a downward direction; but in no case do they form any lateral adhesion with their axis, and there is consequently no raphe, and the foramen and point of attachment retain their original position; the ovula are, therefore, atropous; and the circumstance of the foramen occupying the lower extremity of the seed, arises from the ovula being forced to take a downward direction by the overhanging placenta. The hilum or point of attachment appears to be placed a little obliquely on the inner base of the seed from the extension of the winged border beyond it, which in this case consists of the cuticle merely and not of the entire substance of the testa. The testa in *Coniferæ* consists of a single integument only, the secondine of Mirbel, as Mr. Brown pointed out many years ago; and what I described as a second integument in *Pinus bracteata* and other species of the group of Silver Firs, is merely the cuticle of the nucleus, which in all these species is very conspicuous, and similarly winged like the proper testa, which by its open apex exhibits an analogy to the testa or cupula of *Taxus*.

The cotyledons in most *Coniferæ* are verticillate, and we therefore constantly observe a tendency to assume the same arrangement in the after leaves and other organs derived from them; but from the elongation and unequal development of the axis, the verticillate disposition is departed from, and they most frequently exhibit a spiral arrangement. A multitude of such spires in close contact, as happens in the branches of *Araucaria* and in the cones of *Pinus*, would of course give an indefinite appearance to the series; but in no case does the number of leaves in such a verticil exceed ten. In *Cupressus* the cotyledons are two and opposite, and we constantly find the after leaves opposite, the pairs crossing each other give to the leaves the appearance of being arranged in four rows. In *Callitris* the leaves are arranged in fours, as in *C. quadrivalvis* and *octovalvis*, and the pericarpial leaves

consist of a single verticil in the former, and two verticils in the latter, species ; or they are disposed in threes, as in *C. Ventenatii*, and the pericarpia then consist of two verticils or six pieces. In *Pinus* and other genera, the verticillate arrangement is completely re-established at the nodi, or points where the elongation of the internodes ceases, as is seen by the buds or branches, although the leaves themselves, from whose axils they proceed, are often reduced to the condition of mere scales ; and we may also remark, that the abortive branches of the *Strobus* tribe present a series of verticils of leaves, like the young seedling with its cotyledons. These facts, in my opinion, tend to overthrow the beautiful theory of the spiral development of the foliaceous organs, which has amused and puzzled the botanical world for some years past.

I regret that in the only mature seed of *Athrotaxis*, which I had an opportunity of examining, the embryo had been destroyed by some insect ; but, from the leaves in *A. cupressoides* being in pairs, I conclude that the cotyledons are two, and that the fifth leaf of the spire in *A. selaginoides* is the first of the succeeding third pair.

As in many genera of *Coniferae* the pericarpia are seen to differ but little, either in form or arrangement, from the ordinary leaves of the plant, we should expect to find a corresponding simplicity in the structure of the male organs. The scales, as they are usually termed, of the male spike I consider to be the antheræ, although they usually present a foliaceous character, and the thecæ as parts of a simple anther, a portion only of the subcutaneous cellular tissue being apparently converted into pollen. In the greater part of the genera of this family, such, for example, as *Cupressineæ* and *Taxineæ*, where the thecæ are arranged in a single series and situated at the external base of the scale, it would seem to be a portion of the under surface of the modified leaf that becomes transformed into pollen ; and this is also the case in *Cunninghamia*. On the other hand, in *Dammara* and *Araucaria*, where the thecæ are numerous and disposed in a double series, a portion of both surfaces of the leaf may be supposed to be converted into pollen. On examining the scales or anthers at an early period, the masses of pollen will be found to present the appearance of small elevations occupying the lower base of the scale. At this period the raised portions of the cuticle present no suture or determinate line of dehiscence, although they are found to burst

in a regular manner on arriving at maturity. In *Athrotaxis* the lower edge of each side of the modified leaf assumes the condition of the cell of an ordinary anther; and here it is evident that both surfaces are employed in forming the cells, for their walls are continuous with the substance of the scale: but in the rest of the *Cupressineæ*, it would seem that the upper surface of the modified leaf or anther remains unchanged, and that a portion of the under surface only becomes polliniferous, the pollen occupying 2, 3, or 5 separate spots indicated by the raised and altered portions of the cuticle which cover them. These polliniferous thecæ are analogous to the subdivisions of the anthers of *Rhizophoreæ*, *Laurineæ*, &c., and are in all cases unilocular, and, as far as I have observed, destitute of any septum; their line of dehiscence is various, being sometimes in the direction of the axis, and sometimes contrary to it. I ought to except *Athrotaxis* and *Pinus*, in both of which the scales differ but little from the ordinary condition of the anther in other plants. My opinion of the scales being simple, and not originating from the confluence of several antheræ, is founded upon their resemblance to the bractes, and their transition through them to the proper leaves, from their nervation, which is entirely that of a simple leaf, exhibiting no traces of composition; and lastly, from their assuming in *Pinus* and *Athrotaxis* the ordinary condition of the simple anther. It may be worth noticing, that in *Athrotaxis selaginoides*, where the leaves are acuminate, the apex of the anther is also pointed; and in *A. cupressoides*, in which the leaves are obtuse, the anther is likewise blunt. The wood of *Athrotaxis* presents nothing unusual in its structure, but resembles that of *Cryptomeria*, except that the dots on the vessels are fewer.

I am indebted to my friend Dr. Lindley for the opportunity of giving figures and descriptions of both species of this curious genus, the specimens from which they were taken being contained in his rich herbarium, and having been sent to him, along with many other interesting plants, by Mr. Gunn, a zealous botanist, who is settled at Launceston in Van Diemen's Land. The drawings have been done under my inspection by my young friend Mr. Kippist, and they afford a good specimen of his success as a draughtsman.

The generic name alludes to the crowded disposition of the leaves and scales of the female spike, and is compounded of *αθροος*, *confertus*, and *ταξια*, *ordo*.

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Since the preceding observations were in type, I have been favoured by my friend Mr. Smith, of the Royal Botanic Gardens at Kew, with a specimen of *Cunninghamia sinensis*, bearing several male catkins, and a full-grown cone. A careful examination of this remarkable plant has satisfied me that its proper place in a systematic arrangement is among the *Cupressineæ*, next to *Athrotaxis* and *Cryptomeria*, to both of whom it is related in a nearly equal degree. In the form, structure, insertion, direction, and number of its ovula it agrees entirely with the former genus, from which it is principally distinguished by its elongated aggregate male spikes, and by the addition of a third polliniferous theca. The placentary region is crowned with a thin, narrow, minutely toothed border, clearly of the same nature with the remarkable toothed organ, which I have described as the pericarpium in *Cryptomeria*, and which, singular as it is, can no longer be regarded in any other light than as an excessive development of the placentary region, and what I have described as a bracte is really the apex of the pericarpial leaf. The enlarged placentary region, and the erect ovula, are characters amply sufficient to separate *Cryptomeria* from *Cunninghamia*, in which the polliniferous thecæ are fewer, and altogether free. The striking resemblance, both in form and structure, of the antheriferous scales to those of the female spike, and also to the bractes and leaves, clearly show that they are all modifications of one and the same organ. In all the three genera above-mentioned the antheriferous thecæ bear an evident relation to the number of the ovula, the latter apparently originating in all cases from the upper, and the former from the inferior surface of the modified leaf. The direction of the ovula, which in all cases are atropous, is evidently a character of no more than generic value in this family.

March 6, 1839.

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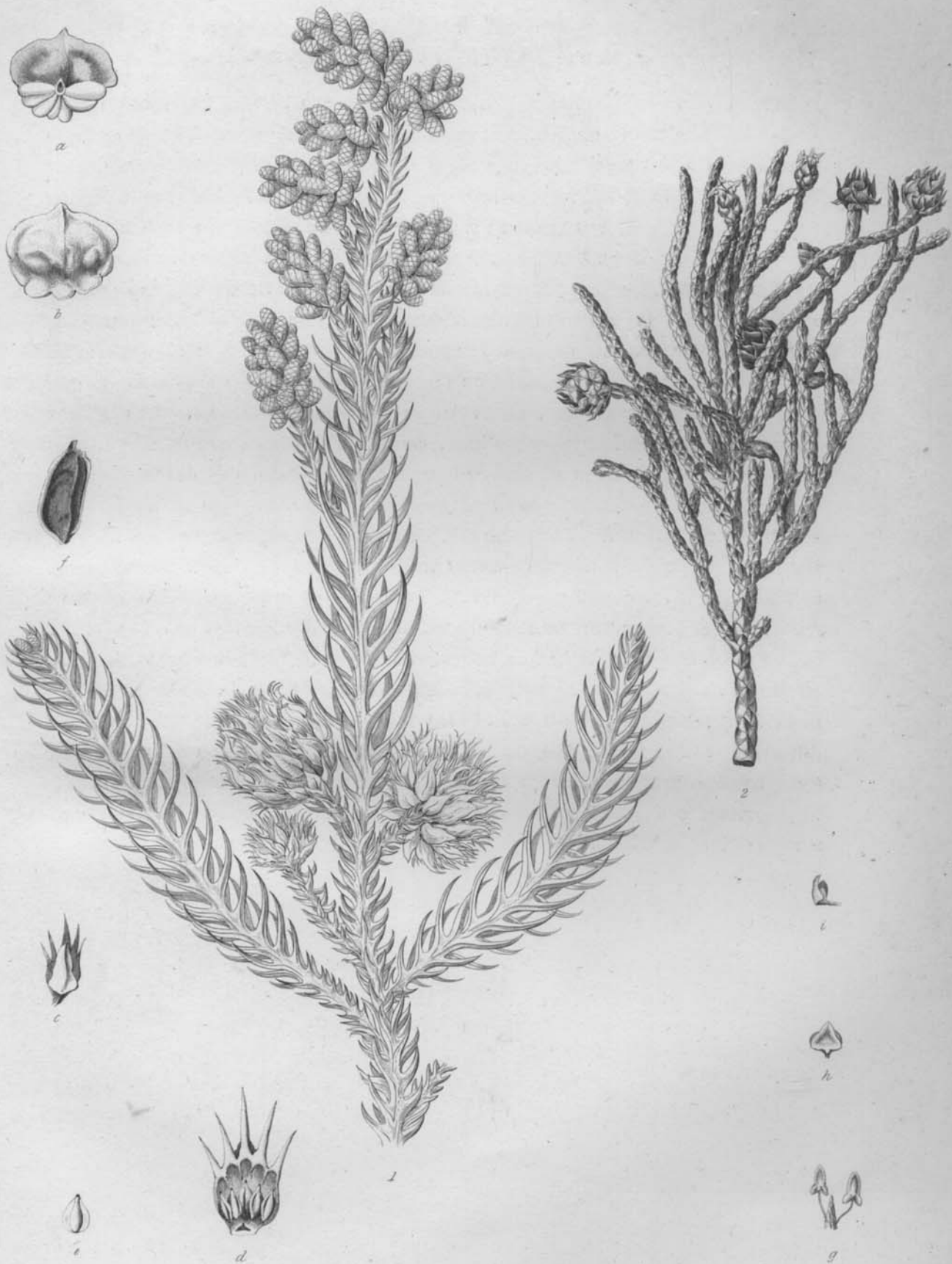
## EXPLANATION OF THE PLATES.

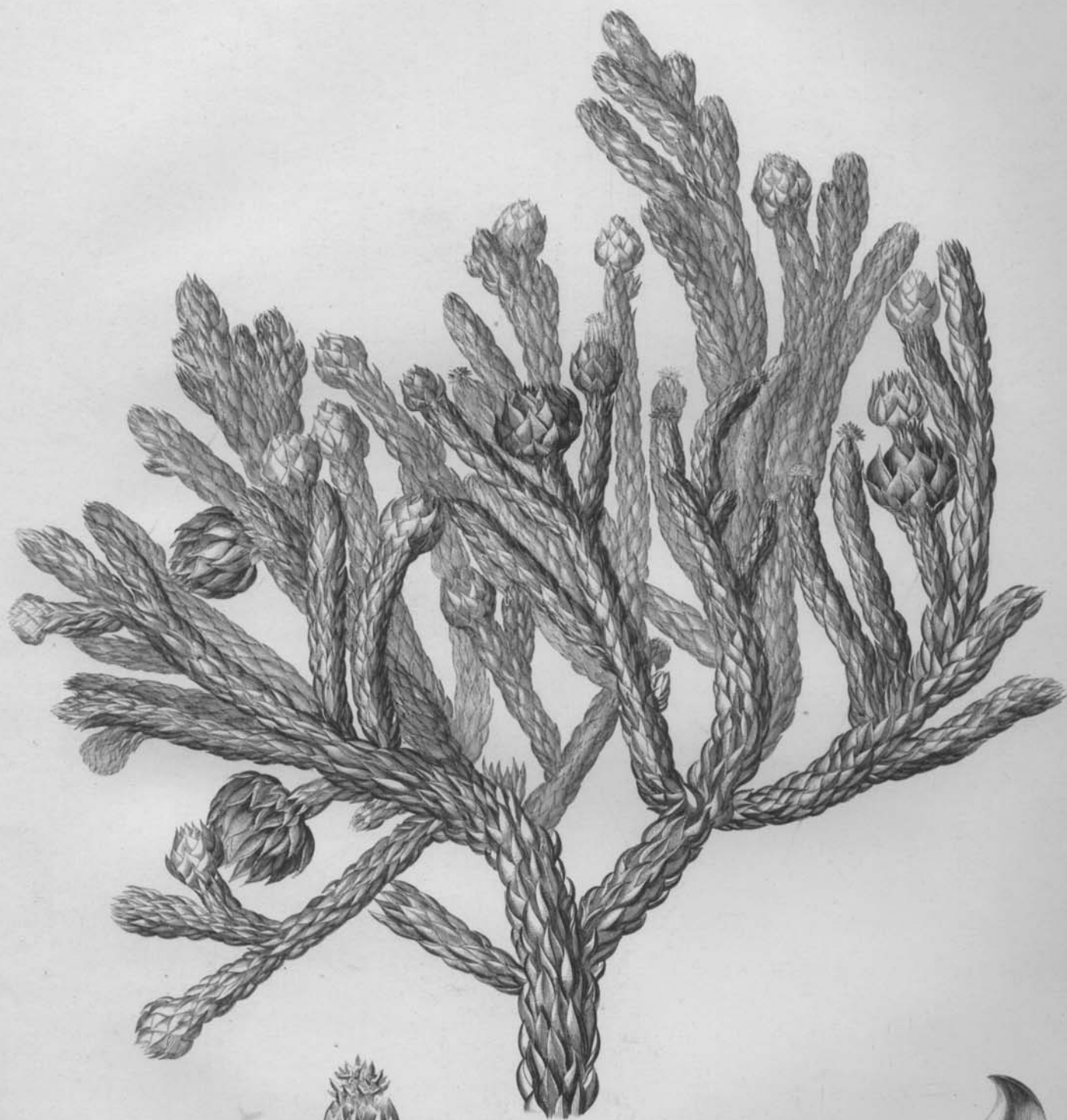
### TAB. XIII.

Fig. 1. *Cryptomeria japonica*.

- a.* Antheriferous scale, front view, showing the five thecæ. *b.* Ditto, back view; both magnified. *c.* Scale of cone, with its bracte, back







b



a



c



f



e



d

view: natural size. *d.* Ditto, front view, showing the five ovula; magnified. *e.* Seed, separate; natural size. *f.* Ditto, magnified, showing the hilum at the base, and the tubular foramen at the apex.

Fig. 2. *Athrotaxis cupressoides*.

*g.* Rhachis of the male catkin, with two of the anthers; magnified. *h.* Scale of cone, back view. *i.* Ditto, side view; both natural size.

TAB. XIV.

*Athrotaxis selaginoides*.

*a.* Extremity of a branch bearing a male catkin; magnified. *b.* Antheriferous scale; magnified. *c.* Scale of cone; natural size. *d.* Ditto, with the three ovula; magnified. *e.* Seed; natural size. *f.* Ditto, showing the hilum at the upper, and the tubular foramen at the lower extremity; magnified.