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## Transactions of the Botanical Society of Edinburgh

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tped18>

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Professor C. Piazzì Smyth

Published online: 01 Dec 2010.

To cite this article: Professor C. Piazzì Smyth (1860) III. On the Manner of Growth of *Dracæna Draco* in its Natural Habitat, as Illustrating some Disputed Points in Vegetable Physiology, Transactions of the Botanical Society of Edinburgh, 6:1-4, 250-262, DOI: [10.1080/03746606009467739](https://doi.org/10.1080/03746606009467739)

To link to this article: <http://dx.doi.org/10.1080/03746606009467739>

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III. *On the Manner of Growth of Dracæna Draco in its Natural Habitat, as Illustrating some Disputed Points in Vegetable Physiology.* By Professor C. PIAZZI SMYTH. (Plate VI.)

Having recently mentioned to my friend, Professor Balfour, some ideas which had occurred to me from attention to the general aspects of *Dracæna Draco*, when growing in its native climate, and manifesting certain peculiarities on a scale of very striking magnitude, he informed me that similar views had been already arrived at by the physiological researches of several eminent botanists. Their opinions, however, not having yet been proved to the satisfaction of all their brethren, and being of late even pointedly opposed by some great names, the question he thought was still quite an open one, and the acquisition of more facts very desirable.

In illustration, he both referred me to his own important "Class-Book," where the names and opinions of authorities on both sides are abundantly given; and subsequently directed my attention to the "L'Institut" for February 9, 1859; on account of its full report of a Commission of the Academy, consisting of MM. Brongniart, Moquin-Tandon, and Payer, appointed to sit in judgment on a paper by M. Hetet, Professor of Botany in the Naval Medical College of Toulon: the paper being descriptive of a series of excellent practical experiments instituted by him on a variety of plants in the Botanical Garden, in order to satisfy his mind as to the radical theories of Petit-Thouars and Gaudichaud.

The Commission just named recalls, in its eloquent and powerfully written report, the "vivacity" wherewith those theories were received on their first announcement at the Institute; the favour which they gradually won, and then at length their adoption; until the researches of Mirbel and Trecul in France, with Mohl's in Germany, gave rise to directly opposite opinions; and in Parisian circles, after abundant discussion and severe contest, were finally considered to stand for the law of nature.

M. Hetet, however, buried in the provinces, was still a disciple of Gaudichaud, and is severely handled by the reporters for not having been cognisant, when beginning his experiments, that a similar series had already been instituted by M. Trecul, and, above all, published by the Academy

three years before. Nevertheless the Commission itself appears to pass over several published works without mention; and one wonders why. For although the neglected authors may not be always exactly academical, yet some of them have had opportunities, in the course of foreign travel, of studying in distant primeval forests the leading features of vegetable growth on a scale, as to size and time, otherwise perfectly unapproachable; and in that way to come to a knowledge of facts, which, in a practical and inductive science, must be of most important aid in drawing true theoretical conclusions.

Compared with such observation of nature, the hot-house plants of metropolitan botanists can be little more than the index of nature's mighty volume, and are therefore totally unable to supply the *whole* information required; and even though their living tissues be cut and carved upon in numerous experiments, the circumstances are all so thoroughly exceptional, that the results can hardly be less so too. Indeed, it is not a little remarkable to find that those generally who have seen the plants growing in their own natural habitats, hold to one set of opinions, and those who have not, to another.

Which of the two are right, if either of them fully, posterity is alone entitled to say; but we may probably be allowed to venture the suggestion, that if, in the inability of every one being able to travel, those who do, were to publish more frequently, as well as more fully, what they have observed, there would be greater uniformity of botanical ideas and better theories amongst all classes of men. The difficulty will, of course, be felt by many, as it is by myself, of not being scientific botanists; but if we do not pretend to that position, and merely confine ourselves to stating undoubted facts which we have met with frequently in nature, but not seen well described in books, if at all, leaving to others to assign their place and their value in the theoretical fabric of science, we are surely entitled to hope that our attempts will not be regarded as altogether useless.

With such a purpose then, and the desire of adding somewhat, though in ever so small a way, to the stock of exotic information and observation already in the hands of the learned, I will attempt to detail what I have lately had

special opportunity of witnessing, as to some of the characteristics of growth in *Dracæna Draco* when flourishing, as indeed it only can flourish, under the very peculiar meteorologic conditions of its native island of Teneriffe.\*

Let us commence, then, with that celebrated historical example the great Dragon-tree of Orotava, according to Baron Humboldt 5000 or 6000 years old; according to Sir John Herschel, "supposed to be the oldest tree in the world;" and according to French naturalists of the catastrophic school in geology, "so old as to have witnessed some of the last revolutions which the surface of our planet underwent prior to the advent of man;" or to speak in the most moderate terms and in words which no one will venture to contradict, the oldest specimen of this species of tree that has yet been brought to the knowledge of man.

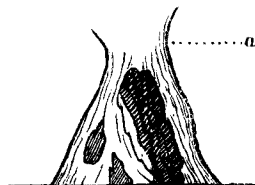
After considerable study of the tree, and careful examination of all the photographs which were taken of it in 1856, as well as comparison with other trees of the same species in Teneriffe, and with reminiscences during many years of allied kinds in the equally luminous atmosphere and high radiation influences of the N.W. of the Cape colony, I am inclined to describe its characteristic figure, when freed from the effects of accident and violence to be,—

1st, Trunk, pyramidal, hollow, vertically, and widely fissured; deeply corrugated longitudinally, corrugations dividing as they descend. (See Fig. 1, approximate only.)

2d, Branches rising upwards at an acute angle; forking and reforking at slightly increasing angles, and entirely naked of leaves except at the extremities of each long, stout, snake-like arm. (Fig. 2.)

3d, The leaves form at the end of each branch a short head of stiff, upward-radiating, sedge-shaped leaves, and appear in the photographs, on days so windy that other trees were all blurred, both their leaves and branches, like

Fig. 1.

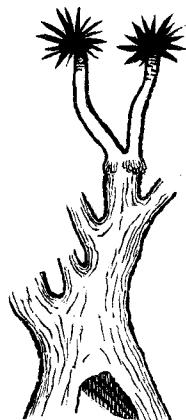


\* See Admiralty Report on "Teneriffe Astronomical Experiment of 1856."

military star-ornaments formed of bayonets, or straight sword-blades, well defined and sharp. (Fig. 3.)

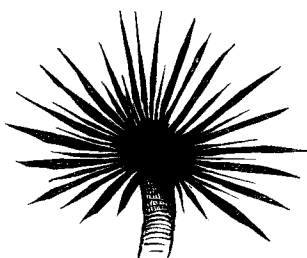
4th, The ultimate branches, or from the leaves down to the first forking, are thick and sturdy, remarkably smooth; or, if marked, only by transverse wrinkles, the base of old foot-stalks; but at the forking there hang a few half-dry radicles (much like those seen on the sugar-cane in the palm-house at the Edinburgh Botanic Garden), and below that point begin longitudinal corrugations, which are carried on through all the lower branchings down to the trunk, where they join the similar corrugations already described. (Fig. 2, approximate.)

Fig. 2.



Let us next consider the stages through which the tree must have passed in the process of acquiring these characteristics; such an inquiry being rendered easy by the photographs which I now produce (some of them being already published in my small work, "Teneriffe, an Astronomer's Experiment").

Fig. 3.



About five years after its production from seed, a *Dracæna* must be like our fig. 3, if we suppose the level of the ground where the stalk terminates. Twenty years later it has still the same head, the same thickness, but so much more length of stem as to have reached the level of the contraction in the pyramidal trunk of the old tree. (See "a" in fig. 1). Then begin the changes in the *Dracæna's* endogenous and palm-like nature. It flowers (or is said to flower, for I have not seen that), branches spring out, and the stem below thickens and corrugates longitudinally. These branches, at intervals of many years, are again said to flower, and again they divide, always becoming corrugated longitudinally below the fork; and the central stem, or trunk, still increasing in diameter, especially towards its

base; where at length ragged apertures appear, showing the interior to be hollow.

The simple explanation of all these appearances, as it occurred to me on the ground, was, that when the twenty-year old tree flowers and produces branches, these are essentially young trees, or viviparous offspring, as sometimes seen, but less successful in result, with the American aloe; and endued with a certain parasitical power, which enables them to strike root as freely into their parent's bark, and through it to work their way down to the ground, as their parent did into the earth itself. The soft succulent nature of the *Dracæna's* stem, with its power of reforming an external bark, may much conduce to this result; the end of which is, that the parent, completely enclosed by the in-osculating roots of its parasitical offspring, dies and decays away in the interior, leaving the family of young trees supported up in the air by the hollow-cylinder of their own coalescing roots; just as, *mutatis mutandis*, a small *Pandanus* in the Botanic Garden, with its original stem severed and cut away, is supported up in the air, entirely and most visibly by aërial roots previously sent down from the branches.

At every fresh branching of the *Dracæna* then, we may conclude one family of the tree to have died, and to be replaced by another generation growing on the summits of the preceding ones, and sending down their roots through the bark of all the others and the original stem, to the ground.

In the *Pandanus*, or in the *Banian*, where the descending aërial roots come out from stem or branches as visible, separate, stick-like forms, and even in the acrogenous tree-ferns, where the similar roots, though closely embracing the stem, are as distinct from it and each other as ivy branches from the side of a house to which they cling, there is no uncertainty in the mind of any one. With the *Dragon-tree*, however, the similar case that obtains is not so immediately apparent; but on attentive examination of all the circumstances of the classic Orotava specimen, (whose illustrations are so intensified by their long ages of duration), such as the actual rootlets at the base of the last branchings, the longitudinal corrugations beginning below them, the tendency of the trunk both to separate and split up into forms with vertical rounded edges, as well as to expand its circle

below (as roots do when trying to keep pace with the expansion of branches above), and finally, the remarkable filling up and rounding off of the lower angle of branch and stem with increase of age—all these circumstances tend to indicate the apparent trunk to be merely a collection of descending roots; varied, however, from other trunks, in the manner in which nature so loves to vary, that it forms at last another distinct step, as much beyond the *Tree-fern* as that is beyond the *Pandanus* in the scale of approach in the external figure of their stems to the stem of a standard dicotyledonous tree.

Hence we have, in the so-called trunk and branches of *Dracæna Draco* (monocotyledonous), the radicular and vertical formation theory of Petit Thouars and Gaudichaud, producing a horizontal growth or increase, without any necessity for referring to the horizontal theory of Duhamel, Mirbel, and Trecul. There is not, indeed, much appearance of Gaudichaud's extreme notion of the whole stem being made up of phytons placed one over the other, and of roots descending from every leaf-base; on the contrary, we see a marked confinement of the roots to the lower end of the stem, and of the leaves—the fresh ones at least—to the upper end; in so far rather confirming Mirbel's view of there being no early connection between the leaves and roots of a *Date-palm*.

The tissue, however, capable of giving off roots, may extend the whole way between the green leaves and the roots; and though generally in a dormant condition, may be called into activity by such experiments as those of M. Hetet's on a *Yucca* at Toulon, or more simply by the operation of planting a stem cut off in its middle—*i. e.*, half-way between roots and leaves. This experiment I have actually tried, though not intentionally; for, having brought home in 1856 a broken branch of *Dracæna Draco*, and presented it to the late Lord Murray, he confided it to the care of Mr M'Nab at the Botanic Garden, under whose skilful cultivation it not only lived, but produced new leaves during more than a year; and although since very much decayed, it is not yet quite dead, after two and a half years' severance from its parent tree; and on examination has been found to have formed several roots.



So, far, then, on the strength, chiefly, of what I have observed myself. But how does that accord with the testimony of other and older observers. Amongst them, as every one knows, there is an engraving of the celebrated tree of Orotava, deemed for more than half a century of unimpeachable accuracy, and extensively copied in our own as well as other countries—viz., the view in the “Atlas Pittoresque” of Baron Von Humboldt. How does that plate agree with the principles maintained in this paper? Very imperfectly, I am sorry to say, for there is hardly anything there given of those features which I have described as essentially characteristic; and in a new edition of MacGillivray’s abstract of the great traveller’s works, published in this city in 1857, or after I had brought home my photographs, and exhibited them in public in 1856 and 1857, the editors have preferred to abide by the Aberdeen professor’s copy from Humboldt in the first edition, although it deviates further still from the real tree, as well as from my accounts and measures.

Let not this, however, immediately decide the question, for Humboldt’s written description differs considerably from the drawing he has published; and this, though going by his name, was not executed by himself, nor by any one who had ever seen the object in question, but by a Parisian artist employed to copy a sketch of M. Ozone’s, a companion of De Borda, who had visited Teneriffe about twenty years before Humboldt, and made the original drawing from nature. Now this original, according to a copy recently obtained by my father (Admiral Smyth) from the French Hydrographic Office, started with a large amount of prejudice in favour of European types of trees, which was increased by Humboldt’s artist, M. Marchais, and unconsciously carried further still by MacGillivray. So that over and above the size being enlarged to at least double the real measure, the trunk is made solid in place of hollow, cylindrical instead of pyramidal, and is unmarked, together with its branches, by the longitudinal corrugations; the abortive radicles nowhere appear; and the foliage is altered from its really scanty terminal tufts to the rich umbrageous appearance of a many-leaved *dicotyledonous* tree, such as an oak or an elm.

On comparing this drawing with my Teneriffe photographs, the editors of the MacGillivray edition must surely have assumed that I had put up the camera before an altogether erroneous tree; though it is rather surprising that botanical theory should not have taught them, as well as the public, the impossibility of the long approved representation in their woodcut being correct, for its deviations from nature and *Dracæna* growth are so very glaring. Amongst better botanists, however, some suspicions had here and there begun to be entertained; and I am happy to record that, before I went out to Teneriffe, Professor Balfour, when having a class diagram painted from Humboldt's tree, instructed his artist how to modify the foliage so as to make it true to what he knew a *Dracæna* must more nearly be. More lately, too, Dr Greville, in another class diagram which rises to the scenic effect of an artistical picture, as well as in a plate for a proposed publication—whose appearance is immensely to be desired for the new illumination it will throw on certain forms of natural beauty—"The Scenery of Plants," has profited largely from theoretical deductions, assisted by the photographs above mentioned; and has, without any immediate communication with me, considerably approximated, or rather attained, independently to the principles I have been endeavouring to establish.

A more extraneous proof, however, is found in the fine lithographs of Barker-Webb, and Berthelot's large work on the Canaries, published about twenty years ago in Paris, and presenting us with several portraits of Dragon-trees of various sizes, taken direct from nature.

Indeed, I might rest the case here, had not a more remarkable, as well as unexpected, confirmation still appeared in Germany this very year, where Dr Herman Schacht, a name well known to botanical science, has published an interesting work on the plants of Madeira and Teneriffe. This latter island he visited in 1857, or but a few months after I was there; though, too, he saw the same residents with whom I had had the pleasure of conversing in Santa Cruz and Orotava, and though he has published a year and a half after the exposition of my papers before the Royal Society of London, and a year after the appearance of my popular

book on Teneriffe with its stereo-photographical illustrations, yet as he does not seem to have heard anything either of myself or my labours, his testimony may be regarded in so far, as perfectly independent and unexceptional.

How, then, does Dr Schacht represent the Great Dragon Tree of Orotava, for of course in a botanical work on Teneriffe it is figured, and, indeed, made a great deal of, forming, as it does, the decoration of the outside of the volume, as well as one of the plates?

The answer is, that Dr Schacht shows the pyramidal form of the trunk as markedly as I could desire; he also represents its hollowness; the long uprearing of its branches, longitudinally corrugated (one of them) below, capped at their extremities by tufts of sedge-shaped leaves, and with something like indications of the abortive rootlets at the latest forkings.

All this is very satisfactory, indeed it could hardly be more so, thus far; but beyond it there is a certain drawback which cannot be overlooked—a something like that “not pleasant result in the after-taste,” which the Doctor describes as existing in the soft, succulent fruit-flesh of the vermilion-“red glistening berries of the *Dracæna*,” and which demands notice all the more because the great mass of the book is so sterling and trustworthy. We see there, indeed, the able botanist of the modern school most evidently, in his descriptions and drawings of sections of stems, leaf-buds, flowers, seed-vessels, &c.; while his skill in the mechanical handling of the pencil is fully equalled by his rare knowledge of some of the recondite laws of *composition* in form, and light, and shade, in landscape pictures. His language, too, is eloquent; but unfortunately what he has observed with his own eyes (in such case always with eminent ability and charming earnestness), is often blended on, apparently without distinction, to what he has heard from nameless informants, making his book very dangerous ground for his reader to tread without the exercise of extreme caution, and sometimes of minute criticism.

His description, already mentioned, of the fruit of the Dragon-tree is one of these cases; for he has not only *not* seen it himself, but says that the *Dracæna* generally blossoms so rarely that many natives of Teneriffe have never

seen either flower or fruit, and that the old Dragon-tree has not flowered for many years. This is a strange *pendant* to Humboldt's account in his "Personal Narrative," p. 118 of the original French edition, viz., that the old tree produces flowers and fruit *every year*; but as the great Prussian was only once in Teneriffe, and then only for four days, he could not have made the statement upon his own observation.

Putting this question, however, for the present on one side, for some future author with more time at his disposal, and larger local experience, to clear up, we are inclined to express some surprise at Dr Schacht not having measured the trunk of the tree, and being content, instead, to give a communicated result many years old, and very discrepant from what now obtains. In the absence, too, of any positive information from himself, we may even venture to infer that his drawing of the tree was not from the life. This is indicated by certain internal evidences; such as, *1st*, The disproportion between the size of, or space filled by, branches and trunk (viz. two to three in his drawings, five to two in a photograph from the same point of view), for it is an error such as so good a botanist and draughtsman as himself would never have committed with the real object before him; and,

*2d*, He himself drawing from nature would not have represented the withered rootlets or the branches like tufts of well-shaped leaves, nor would he have misinterpreted the sky seen through the hollow of the tree. But as these faults do appear in his plate, the conclusion follows that he must have copied, modifying as he went on, some one else's imperfect and ill-understood design; not a photograph certainly, or fault No. 1 would not have been incurred, though 2 and 3 might have been; and I even think to have seen in Orotava a large water-colour painting by a resident lady artist, which must have been the prototype of Dr Schacht's published wood-cut.

We may further remark, if, for sake of trying to clear up the tangled difficulties into which our subject has been thrown by want of precision in previous authors, we may be allowed a little license in friendly and well-intentioned criticism, that this woodcut of the Doctor's, equally with Ozone's sketch, can never have been intended by its

scientific author for a portrait of the vegetable patriarch actually as it stands, or as it stood before him; for all surrounding trees and shrubs are utterly eliminated, especially a large laurel in actual contact with the tree. And whereas in the line of copies that have descended from Ozone's drawing, we see the accumulating effect of prejudice in favour of European types of plants; so in Dr Schacht we have the curiously diverse prejudices of the hot-house, and the style of plants which grow therein.

The effects of this misapplied knowledge of exotics is chiefly seen in the two young *Dragon-trees*, situated on either side of Dr Schacht's old one, in strange resemblance to Dr Greville's drawing; strange, because there are none such in the neighbourhood of the real tree, and they must therefore have been introduced first by Dr Greville and then by Dr Schacht to illustrate phases of *Dracæna* growth. But how has the latter prevented the natural characteristics? The branches of his young tree "that has three times flowered" are not *Dracæna* branches at all, but are modelled on the disjointed lobe-shaped leaves of the cactus; and they are mounted up so high in the air on a tall *Dracæna* stem, that they would inevitably soon be broken off by the trade-wind, so constant in those latitudes. Mechanically as well as æsthetically, these branches are distressing to look at, for they are not at all adapted to their terrestrial existence; and such an error is all the more inexcusable to be committed on this tree, whose symmetry in its limb-shaped branches is something perfectly captivating, as well on artistic grounds as on the admirable evidence of all wise design which they abundantly exhibit.

On barren lava rock, and other untoward sites, a young *Dragon-tree* might be contorted in a variety of ways; but such a specimen is no more to be taken as typical of *Dracæna Draco* growth, than a hunchback cripple of the Caucasian race. To ascertain the pure type, unalloyed by any adventitious circumstances, is a worthy problem to occupy some future traveller, and is only to be arrived at by collecting and collating numerous examples. An approach to it, however, may be seen in Plate, No. 16 of my "Teneriffe," where the orange trees and Indian corn in the foreground answer for the fertility of the soil; and where the *Dracænas* rise

stately in curves of matchless sweep, and lift their white and delicately rounded, yet strong-limbed arms to the sky, in sculpturesque forms of beauty unknown amongst all other trees of the present day.

Strangely then, indeed, has Dr Schacht erred in his figure of the young branched *Dracaena*, and equally has he with the unbranched one; for while such an ungainly bulbous-topped pole as its stem is extremely improbable to have been produced in Teneriffe, the flattened head of depending leaves is quite impossible to have been met with there, though something of the sort may be found not unfrequently in sickly specimens growing with feebleness in our too dark and damp hothouses at home.

One general and inevitable result of these examinations and comparisons is evidently, the importance of a passing traveller in a foreign land, employing photography whenever a drawing is wanted, if the subject admits at all of being so treated; and coincidently with that, the peculiar advantage for scientific men at home, of being enabled on a disputed point to refer from conflicting artists to any sort of photograph, even one of very indifferent execution, rather than to another artist still.

Under these circumstances I have great pleasure in being enabled to append to this account a "photoglyph" kindly prepared, at Professor Balfour's request, by Mr Fox Talbot himself, from one of my Teneriffe photographs of 1856. (Plate VI.) It represents two young Dragon-trees, of fair normal figure; and may enable the reader to realize much that I have attempted to say of the charming contour of their limbs, and of their general physiognomy, so strikingly different to the trees of our own part of the world.

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Dr Fayrer exhibited a hyacinth which had flowered in an inverted position, with the root at the top of a glass bottle, and the flower in the water. He described the mode of growing such specimens as follows:—"When the 'bulbs begin to shoot, place the root head downwards in a hyacinth-glass full of water, only letting the root touch the water, place the glass in a dark closet until the leaves get two inches long, and then place them in a sunny place to flower.

The flower will be of the same colour in the water as if grown at the top of it. The flowers are the same time in growing in the water as they would be if placed either on the surface or in earth. The water must not be changed; simply fill up the glass as the water diminishes. The bulbs should be placed in water in November. There is also a very curious way of growing hyacinths. It is by placing two bulbs of the same colour together, root to root, the under one in water; place wet moss round both bulbs so as to conceal entirely the upper one; they will flower at the same time—the one in the water, the other at the top. I have often seen them so grown in Switzerland; the moist moss is quite sufficient to nourish the bulbs.”

Mr Sadler stated that he examined the stomata of the leaves of the hyacinth grown under water, and found them in no way differing—either in form or number—from those in the leaves of hyacinths grown in the open air.

14th April 1859.—ANDREW MURRAY, President, in the Chair.

The following Candidate was balloted for and duly elected :—

JAMES G. REID, Esq.

Professor Balfour announced the following donations to the Museum at the Botanic Garden :—

From Sir William Jardine, Bart.—Transverse and longitudinal sections of the stem of *Alnus Canadensis*, grown at Jardine Hall.

Dr Cleghorn, Madras—Pods of *Dolichos* and of *Bignonia*, stem of *Bauhinia scandens* and *Mahonia Leschenaultii*, &c.

J. B. Booth, Esq.—Cones of *Abies Mertensiana*, *Pinus grandis*, *P. Menziesii*, and specimens with fruit of *Thuja gigantea*.

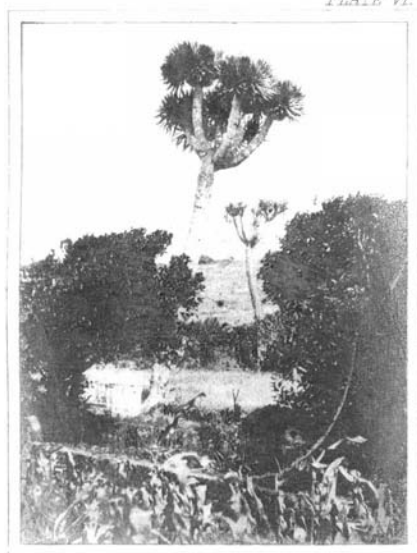
Ralph Carr, Esq.—Transverse section of the Douglas Pine (*Abies Douglasii*).

Messrs P. Lawson and Son—Cones of *Abies Williamsoni*.

Mr William Milne—Fruit and leaf of *Banksia grandis*, fruit of *Banksia occidentalis*, and of another species from King George's Sound; resin of *Dammara obtusa* from the New Hebrides; Cowdie or Kaurie resin of *Dammara Australis*, from Auckland, New Zealand.

The following Communications were read :—

PLATE VI.



Young Dragon trees, near Crotava, Teneriffe.

*Photograph plate by W. H. Fox Talbot Esq.*