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Another note on 1894 – the year of my real awakening to Botany (see typescript)

On Jan 19, 1894, my brother who believed in going to the fountain head, penetrated with me into the students' part of the British Museum Bot. Dept. in Cromwell Road, to ask some question (what I do not now recollect) of the Keeper. [Mr Gepp gave me the record from the visitors' book.]

POST CARD.

THE ADDRESS ONLY TO BE WRITTEN ON THIS SIDE.

Miss Robertson
52 Doods Road
Reigate
Surrey.

[illegible]

BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, LONDON, S.W.

16 July 1903.

Dear Miss Robertson

I am sure you are right – but of course I have personal regrets. I wanted you here and you might have had any invitation you pleased. Never mind – that may come after all.

Yours George Murray.

Highley lith & imp.

ROBERTSON _TORREYA CALIFORNICA

A.R. del.

Agnes Robertson

"Our Magazine" (Nov. 94)
(Magazine of the North London Collegiate School for Girls)

The Ivy-Leaved Toadflax. (P.T.O)

Notes of these are inside "Early Efforts" volume

The Cambridgeshire Times MAY 10th, 1957.

... another plant which only occurs on walls in Britain was introduced even earlier—the Ivy-leaved Toadflax, **Cymbalaria muralis**, which was reported from Hatfield in Hertfordshire in 1640. It was noticed on the walls of the "Great House at Drayton" in the middle of the eighteenth century and in the next 100 years had spread to all parts of the county. Although it is flowering now, its delicate lilac and white snapdragon-like flowers are not very conspicuous and this is reflected in its common names of which there are many—they all refer to the shape of the leaves. **Cymbalaria muralis** means the "cymbal-shaped leaved plant of the walls" and it is known in some parts as the Pennywort. There is little evidence of this plant being grown in gardens, then how has it spread? A look at the seeds is suggestive. They are not small—about the size of cabbage seed, but they are light for their size and have a very rough surface. This probably serves two purposes. Firstly they can easily be blown by the wind, and secondly when they land on a surface they do not easily roll off. Thus in dry weather the seeds are perhaps caught in gusts and carried on to roadside walls where once established the plant maintains itself over the years.

F. H. P.

Contents

Agnes Robertson

THE IVY-LEAVED TOADFLAX.

(LINARIA CYMBALARIA.)

"THIS pretty little trailing plant" is now "perfectly naturalized on old walls and sometimes on rocks over the whole of England, and the southern half of Scotland."° In 1597 Gerarde says that it "growes wilde upon walls in Italie, but in gardens with us;" and in 1640 Parkinson declares that "it groweth naturally in many places of our land." In 1816 we read in Green's Herbal that it "is a native of Italy; but now become common upon walls in and near London." It was known in Worcestershire forty years ago, and probably earlier. It is also known in France under the names of Linaire Cymbalaire, Mère de mille enfants, and Lierre de la terre. Its Dutch name is Muur bloemtje (wall bloom); in Germany it is

called Ephenblättriger or Frauenflachs,* and in Italy "the plant of the Madonna."† It has many English names, of which the most common are Ivy-leaved Toadflax, Ivy-leaved Snapdragon, and Matrimony. In some places it is called Oxford weed,‡ and in the western counties, Mother of thousands.§ Its local Sussex names are Kitty-run-in-the-street, Roving sailor,‖ and Creeping Jenny.‖ These names mostly refer either to the way in which the plant creeps about the walls where it grows, "by help of its long rooting stems,"§ or the ready manner in which it reproduces itself by its abundant seeds.

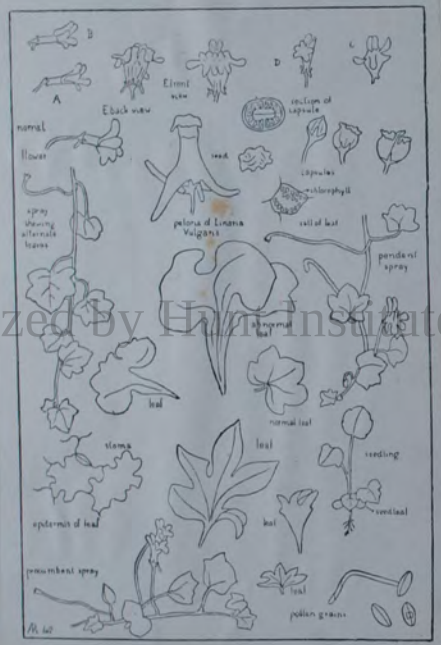
The syllable "flax" in Toadflax, and the name "Linaria," were given to the genus to which this plant belongs, because its principal member, the Yellow Toadflax, had leaves like linum (flax). The distinguishing characteristic of the genus is the form of its flower, and from this our little plant is called Linaria, although no part of it bears any resemblance to the Flax plant. It was formerly referred to the genus Antirrhinum (Snapdragon), but is now separated from it, on account of its spurred corolla. "Antirrhinum," in Greek signifies "opposite the nose," from the mask-like appearance of the flowers."¶ The Greek actors always used masks; and as they had to make themselves heard out of doors, these had large mouth openings. This explains why the Snapdragon flower is called "personate" (mask-like), and how it got its generic name of Antirrhinum, by being, as a country child once told me, "the flower that opens its mouth." Gerarde says that the Snapdragon, Calves' snout or "Todeflax" has "flowres fashioned like a frog's mouth, or rather a dragon's mouth, from whence women have taken the name Snapdragon." This explains the origin of the syllable "toad" in Toadflax.

The specific name, Cymbalaria or Cymbalarica (from the Latin Cymbalum, a cymbal), is the one which Gerarde uses, calling it Cymbalaria Italica, and saying "Matthiolus calls it Cymbalaria (to which Lobel addes) Italica Hederaceofolio . . . . and lastly Columna calls it Linaria Hederacfolio," of which our name Ivy-leaved Toadflax is a literal translation. It is difficult to see the connection between any part of this plant and a "cymbal," but as Gerarde places it

* Sowerby. † Hulme, "Familiar Wild Flowers." ‡ Baxter.
§ Johns, "Flowers of the Field." ‖ Arnold, "Flora of Sussex."
¶ Johns.

Agnes Robertson

Photographic Line Block



HARRIS'S HOSIERY CORNER,
Knickers and Dainty Underwear

Print from block shown.

called Ephenblättriger or Frauenflachs,* and in Italy "the plant of the Madonna."† It has many English names, of which the most common are Ivy-leaved Toadflax, Ivy-leaved Snapdragon, and Matrimony. In some places it is called Oxford weed,‡ and in the western counties, Mother of thousands.§ Its local Sussex names are Kitty-run-in-the-street, Roving sailor,‖ and Creeping Jenny.‖ These names mostly refer either to the way in which the plant creeps about the walls where it grows, "by help of its long rooting stems,"§ or the ready manner in which it reproduces itself by its abundant seeds.

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¶ Johns.

among the "penniwoorts," the old botanists probably saw in its foliage some likeness to the round platter-like leaves of the wall pennywort, known to children under the name of "penny pies."*

We also read that "Bauhine sets it betweene Hedera terrestris (ivy) and Nasturtium Indicum (a species of cress)," apparently from the form and flavour of its leaves.

The whole plant is "dark green and glabrous,"† and consists of numerous slender red-tinged stems, "from three inches to two feet long, procumbent when growing on the top, and pendent when on the side of a wall."†

"The branches are many, long, slender and creeping, upon which grow, without any certaine order, many little smooth thick leaves fashioned like those of ivie, and fastened to stalkes of some inch long. . . . The root is small, creeping and threddie,"‡ and adventitious roots are formed on the long runners. The growth appears to be quickest in hot weather, for a plant that I drew at intervals of a week for six weeks, grew more between August 25th and September 1st, which was a fine sunny week, than in all the weeks before, which were dull and rainy, but Gerarde says, "They are green and flourish especially in winter." An old countryman told me that the winter storms sometimes tore the plant in great masses "back'ards off the wall," and it had to begin freshly to cover the bricks, which it had formerly clothed with a "thick tapestry."§

The fleshy leaves are shorter than their petioles, and usually five-lobed. Their form varies almost as much as that of the ivy leaves. The stems and leaves are often very much tinged with red, the colouring matter seeming to reside in the epidermis, which peels off in transparent shreds. I measured twenty apparently fully developed leaves, and found the average length to be rather more than two centimetres, and the average width about four centimetres. The largest I found were three cent. four mill. by five cent. five mill., and three cent. seven mill. by five cent. four mill. Though the leaves are usually alternate they are sometimes found in opposite pairs.

"In Southern Europe the plant is eaten as a salad, and is a good antiscorbutic, freely administered in diabetes in Hindostan, being

* Johns. † Sowerby. ‡ Gerarde. § Green.

first mixed with sugar."* "The decotion of todeflax taketh away the yellownesse and deformitie of the skinne, beeing washed and bathed therewith," and it "is singular good against the jaundice which is of long continuance."†

The flavour of the leaves is rather unpronounced, but bitter and pungent. Four people who tasted it compared it respectively to the flavour of watercress, endive, nasturtium, and young hawthorn leaves. My great grandmother, a Worcestershire woman, used to speak of a salad prepared from the "Matrimony," but I have been unable to find any recipe for it.

If a bunch of the leaves and stems be offered to a horse or rabbit, he eats it eagerly. The Ivy-leaved Toadflax is often found growing all among the ivy, sometimes really overtopping it, and helping itself along by the ivy sprays. It thus seems that this little plant, whose leaves are "lobed so as to resemble miniature ivy leaves,"‡ has imitated their form in order to protect itself from horses, cattle and other creatures, who will not eat ivy because it is so very bitter, and who probably mistake the edible toadflax for the unpalatable ivy, and so leave it alone. Though this supposition cannot be absolutely proved, it seems at least to be in accordance with the laws of evolution.

The inflorescence is axillary, the flowers growing separately on long, slender peduncles. Gerarde gives a quaint description of the blossom. He says (speaking of the petioles), "with these stalkes come forth others of the same length that carry spur fashioned flowres of the shape and bignesse of the female Fluellen, their outside is purple, their inside blew, with a shot of yellow in the opening." When Gerarde speaks of the "shot of yellow" he probably refers to the two lines of brownish yellow hairs in the tube on which the pollen falls. These two rows of hairs serve as hedges to a little path going straight down to the nectary. This path starts between the two yellow spots on the palate. There is a little dip between them, and I have seen a moth settle, and put his proboscis into the flower between the two swollen spots, and down between the two rows of hairs to the honeybag. He must have got some pollen off the hairs on to his proboscis, and so carried it to another flower. Besides the brown moth I have seen a bee, and a curious

* Sowerby. † Gerarde. ‡ Sowerby.

long-bodied, greyish, hairy fly going into the flowers. I saw the fly going in three times, and settling on the flowers or leaves without going in four times, and I saw the bee go in twice. I have not seen enough insects to account for the cross-fertilization of the majority of the flowers, but they may be fertilized at night by moths, etc.; or possibly they are sometimes self-fertilized. I have twice been out at night with a lantern to see if the flowers are visited by nocturnal insects, but I could find none. It was not very warm weather which perhaps may account for my want of success.

There are four didynamous stamens, whose anthers, when dehiscing, adhere slightly in pairs. Between the inner and shorter pair is a staminode, showing that the irregular flower is a development of the regular type with five stamens, from which all the scrophulariaceæ seem to have evolved. We find a staminode also in the genus scrophularia (figwort), where the fifth stamen is represented by a small scale.

The flowers vary a good deal in colour, being pale when growing in the shade and much darker when in the full sunlight. I have found several curious abnormal blossoms. Two of them (marked A and B in the accompanying illustration) seemed reverting to a simpler form by losing the spur, or one of the lobes of the lower lip, and the three others (C, D and E) seemed gradually tending towards a "peloria." I give a drawing from a pressed specimen of the "peloria" variety of Linaria vulgaris.

The flowers turn to the light, away from the wall on which they grow. When the corolla falls off, the peduncle lengthens, turns, and curves back, until the capsule touches the wall, or at least gets near it. Very often the capsules partially bury themselves in the earth in the chinks of the walls. This is a very economical proceeding, as the seeds get nicely sown in the wall, instead of being dropped on to the earth beneath, where they would have scarcely any chance against the grass, etc. I measured four peduncles when the flower was in perfection and afterwards when the fruit had attained its maximum size. I give the measurements.

Length of peduncle—

When flower was in perfection.	When fruit had attained its maximum size.
1 cent. 2 mill.	3 cent. 8 mill.
3 cent. 2 mill.	6 cent. 4 mill.
1 cent.	2 cent. 4 mill.
1 cent. 2 mill.	4 cent. 4 mill.

Agnes Robertson

The longest peduncle with a capsule that I measured was nine centimetres, but I do not know how much it had increased since it was in flower.

The capsules are "about the size of a coriander seed."* The seeds are first whitish green, then yellow, and afterwards black; they are rough and wrinkled. "The flowers yield a yellow, but not very permanent dye."*

I have done what I could in the six weeks during which I was able to observe this plant, but I feel that I am only on the threshold of an almost inexhaustible subject, and that it would need the careful observations of years to make a complete monograph of the Ivy-leaved Toadflax.

AGNES ROBERTSON.

* Sowerby.

Agnes Robertson
9 Ellsworth Terrace
Fremdale Hill N.W.

Agnes Arber
52 Huntingdon Rd
Cambridge

[See end for my new botanical history]

1

2

Nature. Jan 28. 1902

Sir Walter Raleigh and Evolution.

I HAVE recently come across a passage in Sir Walter Raleigh's "History of the World" which seems to me sufficiently remarkable for the author to deserve a notable place among those early naturalists who anticipated in some measure the modern views on evolution. In the historical sketch at the beginning of the "Origin of Species" Darwin quotes Buffon, who was born a century and a half later than Raleigh, as "the first author who in modern times has treated the subject in a scientific spirit"; but although, scientifically, Raleigh cannot be compared with Buffon, the fact of his having penned at such an early date the words I am about to quote possesses some interest. The passage I refer to is to be found in the 1621 edition (part i., book i., chap vii., § 9, p. 94). Speaking of the days of the Flood, he says: "But it is manifest, and undoubtedly true, that many of the *Species*, which now seeme differing, and of severall kindes, were not then *in rerum natura*. For those Beasts which are of mixt natures, eyther they were not in that age, or else it was not needfull to preserve them, seeing they might be generated againe by others: as the Mules, the *Hyæna's*, and the like; the one begotten by Asses and Mares, the other by Foxes and Wolves. And whereas by discovering of strange Lands, wherein there are found divers Beasts and Birds differing in colour or stature from those of these Northerne parts; it may be supposed by a superficiall consideration, that all those which were red and tyvel Skinnes, or Feathers, are differing from those that are lesse painted, and were plaine russet or blacke; they are much mistaken that so thinke. And for my owne opinion, I find no difference, but onely in magnitude, betweene the Cat of *Europe*, and the Ownce of *India*; and even those Dogges which are become wilde in *Hispaniola*, with which the *Spaniards* used to devoure the naked *Indians*, are now changed to Wolves, and begin to destroy the breed of their Cattell, and doe also oftentimes teare asunder their owne Children. The common Crow and Rooke of *India* is full of red feathers in the drown'd and low Islands of *Caribana*; and the Black-bird and Thrush hath his feathers mixt with blacke and carnation, in the North parts of *Virginia*. The Dog-fish of *England* is the Sharke of the South Ocean: For if colour or magnitude made a difference of *Species*, then were the *Negro's*, which wee call the Blacke-Mores, *non animalia rationalia*, not Men, but some kind of strange Beasts: and so the Giants of the South *America* should be of another kind, than the people of this part of the World. We also see it dayly, that the natures of Fruits are changed by transplantation, some to better, some to worse, especially with the change of Clymate. Crabs may be made good Fruit by often grafting, and the best Melons will change in a yeere or two to common Cowcummers, by being set in a barren Soyle."

AGNES ROBERTSON.

The Old Hall, Newnham College, Cambridge, January 13.

[Extracted from the *Proceedings of the Cambridge Philosophical Society*, Vol. XII. Part I.]

Notes on the Anatomy of Macrozamia heteromera, Moore.

By AGNES ROBERTSON, B.Sc. (Lond.), Newnham College. (Communicated by Mr Seward.)

[*Received* 14 August 1902.]

Introduction.

Ten species of the Australian genus *Macrozamia* are natives of New South Wales, and one of these, *M. heteromera*, described in 1884 by Moore[1], is of interest as possessing, both in its ordinary form and in its two varieties *glauca* and *tenuifolia*, a type of frond unusual among Cycads. The pinnae are very narrow, reminding us in this respect of *Encephalartos Ghellinkii*, and most of them are forked in various ways (Fig. 4). It occurred to Mr Seward, who has referred to and figured this peculiarity of vegetative structure in his *Wealden Flora*[2], that the anatomy might perhaps be expected to shew some features differing from that of the rest of the genus. He was able to obtain a specimen through the kindness of Mr Maiden, Director of the Sydney Botanic Gardens, who informs us that "as a rule the plant grows in a stiff black clay amongst large stones (basalt); occasionally in sand-ridges (sand overlying clay)." The specimen, which on its arrival in England had been placed in methylated spirit, was handed to me for examination.

The diameter of the stem was about 12·5 cms. in its thickest part. The upper half was covered with leaf-bases, but lower down these had disappeared, and the position of the old leaves was only marked by tangentially elongated ridges. The appearance of the

[1] *Trans. Roy. Soc. New South Wales*, 1884, p. 115.
[2] *The Wealden Flora*, Part II. p. 5, and Plate XIII. figs. 1 and 2.

New Phytologist. Vol II. 1903.

IN a paper published last year in *Postelsia*,[1] K. Yendo points out that owing to the long and irregular coast line of the Japanese islands, a large proportion of their inhabitants are brought into contact with the sea, and hence marine algæ have been utilised for all sorts of economic purposes. Yendo enumerates a number of these seaweeds, and it will perhaps be worth while to draw attention here to a few of the more important.

Laminaria is much used as a food-plant, and in 1894, over 18,000 tons were exported, chiefly to China. The *Laminaria* fishermen wind up the fronds, which sometimes form belts a hundred feet in length and two feet in width, by means of long poles with forks or sickles at the end. Yendo's paper is illustrated by Japanese colour prints, one of which is a most dramatic representation of the Ainu people gathering *Laminaria*.

Porphyra is actually cultivated on a large scale for food! "Slender, bushy twigs are planted in regular rows in shallow and brackish water. Enough space is left between the rows to permit the passage of canoes. Late in winter or early in spring the *Porphyra* plants gather on the twigs." The tiny purple fronds are collected, washed, and dried in layers upon reed mats. They adhere together into a sheet by means of their own gelatine, and these sheets are peeled off the mats, folded and sent to market.

Next to *Laminaria* and *Porphyra* the most useful Japanese alga is *Gelidium corneum*, from which agar-agar is prepared.

Various kinds of *Sargassum* are used as manure, and one species, *S. enerve*, which becomes green on drying, is employed, intertwined with *Laminaria*, in the New Year's day decorations. Yendo says that the plants occupy much the same place in Japanese life that the holly does among the English.

Different species of *Chondrus* and *Gloiopeltis* are boiled up into a kind of laundry starch, and numbers of other seaweeds, are utilised in decoration, or eaten as salads, sauces, etc.

The point to which the employment of algæ has been carried in Japan may be gathered from the fact that Yendo alludes to nearly thirty different species as economically important, although he distinctly excludes from his list those of restricted use.

A. R.

[1] *Postelsia*. The Year Book of the Minnesota Seaside Station, 1901, St. Paul, Minnesota, 1902.

To the Editor of the NEW PHYTOLOGIST.

DEAR SIR,

With reference to my article in the February number of this journal on the subject of the Origin of the Perianth, I have received from Professor K. Goebel, of Munich, an intimation to the effect that I have misrepresented his views on the subject of metamorphosis in flowers by stating that they are both "idealistic" and "resemble Goethe's type-theory." In the first place it must be said that before penning the article I had not read, as I certainly should have done, Professor Goebel's excellent "Treatise on Double Flowers" (1885), a treatise practically exhaustive in the number of interesting and valuable facts it contains. His views on the origin of the perianth are therein, and also in his "Organography of Plants" (the perusal of which I had also stupidly omitted) made plain. On page 276 of the first-mentioned work he says, when treating of the Ranunculaceæ: "It cannot be denied that in many cases petals have arisen from meta morphosed stamens. . . . . But we have no real ground for making this a general rule." Another passage runs thus: "As in this case [Equisetum] certainly in many others, perianth and corolla-formation takes place through transformation of the leaf-rudiments occurring in the neighbourhood of the flower." The calyx he appears to regard with Prantl, as of bracteal origin.

I take this occasion to make every apology to Professor Goebel for introducing his name in connexion with the subject without a discussion of those important views which most directly bear thereon.

But the remarks with which Professor Goebel's name was introduced, had reference to his theory on the morphology of the foliar organs of the flower expressed in an earlier work of his, the "Vergleichende Untersuchungen," and which may be stated thus: "that any foliar organ of a flower, whether sepal, petal, stamen, or carpel, is a modification or transformation of a rudiment, which itself is always of the nature of a *foliage-leaf*." Goebel's view may, in other words, at least, as I understand it, be stated thus: "that the foliage-leaf is the morphological type from which all other kinds of foliar organs are derived modifications." This view, put forward *without any apparent evidence to support or give reason for it*, it is safe, as it appears to me, because correct, to describe as "idealistic." Is it less so than that of Goethe, who merely held that all foliar organs of the plant are modifications of the "leaf," by which he probably meant the foliage leaf? Or, if by type-leaf was meant a purely ideal entity, his view would, in my opinion, be much nearer the truth and might be merely a statement in concrete, though misleading, language of the fact that all foliar organs of the plant are modifications of a primeval ancestral foliar organ now no longer existing, which I for one would be the last to deny. The views of both Goethe and Goebel must be regarded as idealistic for the simple reason that they possess a purely subjective value, being unsupported by the necessary buttress of scientific argument or evidence. On the other hand, Celakovsky's view regarding the ancestral type of the foliar organs, which *is* based on a definite well-thought-out line of scientific argument and theory, is clearly the opposite of idealistic.

ENGLISH HERBALS

BY

AGNES ROBERTSON

[Reprinted from THE POPULAR SCIENCE MONTHLY, May, 1904.]

SPORE FORMATION IN *TORREYA CALIFORNICA*.

By Agnes Robertson, B.Sc.

[Quain Student in Botany, University College, London]

[With Plates III. and IV.]

[*Reprinted from* The New Phytologist, *Vol. III., Nos. 6 and 7, June and July, 1904.*]

STUDIES IN THE MORPHOLOGY OF *TORREYA CALIFORNICA*, TORREY, II.

By Agnes Robertson.

[*PLATES VII. TO IX.*]

[*Re-printed from* The New Phytologist, *Vol. III., Nos. 9 & 10., November and December, 1904.*]

On some Anatomical Features of the Scutellum in Zea Mais.

By Ethel Sargant *and* Agnes Robertson

The *epidermis* of the scutellum develops into a well-marked epithelium over the face which is in contact with the endosperm. We have found that this epithelium folds in on itself in places, forming narrow clefts of considerable depth in the dorsal surface. Both sides are of course lined with the epithelial layer, and the cleft is so narrow that they often touch each other. Traces of secretion are, however, commonly found within these structures which may fairly be described as glands. Their number and size vary in the individuals examined. Their distribution over the dorsal surface of the scutellum is also variable, but they are least frequent near the apex and in the regions bordering on the median longitudinal section; indeed, they are often quite absent from these parts. The glands are fully formed in the ripe seed, and we have not traced their development.

Similar glands are found in the allied genus *Coix*, but in the individuals of *C. lachryma-Jobi* which we examined they were less well developed than in *Zea*.

Vascular tissue.—The main bundle of the scutellum runs upwards to the apex from the level at which it is inserted on the stem of the kilo. Just above the insertion this massive bundle is collateral, with some slight suggestion of a double structure. The single group of xylem is on the ventral side of the bundle. Higher up in the scutellum the xylem begins to creep round the phloëm, at the same time throwing out short branches consisting of tracheids and albuminoid cells. Near the apex the main bundle becomes amphivasal, and slender branches are given off profusely from the dorsal face of the bundle. They penetrate all the tissue on the dorsal side of the scutellum apex, but are most frequent near the midrib. These little branches always end freely just under the dorsal surface, commonly about two rows of cells below the epithelium. In character they resemble the transfusion tissue described by Professor Weiss in Stigmarian rootlets.

We have not observed any relation between the terminations of the vascular branches and the epithelial glands. These terminations occur in those parts of the scutellum where the glands are least frequent.

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LONDON

The Anatomy of the Scutellum in Zea Maïs.

BY

ETHEL SARGANT AND AGNES ROBERTSON, B.Sc.

With Plate V.

BOTANISTS have long been familiar with the external structure of the Grass-embryo, which is sufficiently different from that of the embryo in other Monocotyledons to leave some doubt as to the homology of their parts. We began the examination of several Grass seedlings in the autumn of 1902, hoping that their anatomy at a period soon after germination might throw light on this vexed question. We did not propose to monograph the family from this point of view, but, having chosen a few genera from very different parts of it, to compare their seedlings anatomically with each other, and with those of the Monocotyledons already worked out by one of us.

Even this skeleton scheme has not yet been completed, for we have not succeeded in getting all the material desirable. Side issues of some importance have been raised, however, and in particular the anatomical structure of the Maize scutellum offers some features of interest which we believe to be still undescribed[1]. They are clearly bound up with its function as a sucking organ, and the subject is thus a digression from the main morphological line of research, and is more conveniently treated in a separate form.

External Morphology of Embryo.

Within the ripe fruit the main axis of the embryo is triply protected. Embryo and endosperm alike are enclosed in the dry covering of the grain. When a part of this is removed, the whole embryo is seen lying against one face of the endosperm (Fig. 3, Pl. V, cf. also Figs. 1 and 6). The second covering is formed of the scutellum (*sc.* in Figs. 1, 5, 7), a cushion-like structure which is wrapped round the embryonic axis and still conceals the greater part of it in the first days of germination (Fig. 3).

[1] Ethel Sargant and Agnes Robertson, 'On some Anatomical Features of the Scutellum in Zea Maïs.' Report Brit. Assn., Southport, 1903, p. 860.

CYTOLOGY AND CLASSIFICATION.

A Lecture

By Agnes Robertson.

[*Re-printed from* The New Phytologist, *Vol. IV., Nos. 5 and 6, May and June, 1905.*]

RECENT WORK ON THE "REDUCTION DIVISION" IN PLANTS.

By Agnes Robertson.

[*Re-printed from* The New Phytologist, *Vol. V., Nos. 1 and 2, January and February, 1906.*]

THE NEW PHYTOLOGIST.

A BRITISH BOTANICAL JOURNAL.

EDITED BY A. G. TANSLEY, M.A., F.L.S.,

ASSISTANT PROFESSOR OF BOTANY, UNIVERSITY COLLEGE, LONDON.

This Journal, now (1906) in its fifth year, publishes short original papers, critical articles and reviews, summaries of recent advances in botanical knowledge, occasional notes and correspondence on all botanical topics, the preference being given to those contributions dealing with matters of general interest to botanists and those branches of the science undergoing rapid current development. The Journal is supported by all the leading British Botanists.

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New Phytologist: April 1906

THE ABSENCE OF AN EPIDERMIS IN THE ROOTS OF MONOCOTYLEDONS.

A SUGGESTION.

IT is a well known fact that the iodine test for starch always fails in the case of the leaves of certain plants, especially many Monocotyledons, since in such leaves sugar only is present. Stahl[1] has shewn that the presence or absence of starch is a symptom of a strong or weak transpiration current, and he accordingly divides plants in two classes:—I. Starch-leaved, strong transpirers, II. Sugar-leaved, weak transpirers. He has pointed out that there is great competition amongst plants for the salts in the soil, and that fungi are especially successful in this struggle, as is shewn by the fact that their ash is extraordinarily rich in mineral matter. There are two ways in which a normal green plant may attain success in the struggle for salts. One way is to have a very strong transpiration current, so as to secure a great "turn over" of water. This is the method adopted by the starch-leaved plant. The other method adopted by the sugar-leaved plant is to live symbiotically with a fungus, and to profit by its power of securing salts. This plan seems to be more general than is commonly supposed. According to Stahl about one half of the vegetable kingdom is mycotrophic! Stahl finds that a large proportion of the Monocotyledons characteristically belong to the sugar-leaved mycotrophic class, especially the Liliifloreæ. The Gramineæ on the other hand are starch-leaved and autotrophic. That the aid of a mycorhiza would be particularly valuable to a Monocotyledon becomes clear when we recall the usual life history of a member of this class. Miss Sargant[2] has brought forward a large body of facts on which she bases the theory that the Liliifloreæ are the most primitive of the Monocotyledons, and have been evolved from the Dicotyledons through the adoption of the "geophytic" mode of life, which is adapted to a climate in which a long dry season is succeeded by a short rainy season. A "geophyte" remains buried beneath the soil as a tuber, bulb, or root-stock for the greater part of the year, and only puts out roots and leaves during its comparatively short growing season. Now a geophyte which has to produce a fresh

[1] Pringsheim's Jahrbuch, 1900.

[2] Annals of Botany, January, 1903.

root-system every growing season, and which needs to get its life processes into full swing at the shortest possible notice, cannot possibly tap so large an area for salts as an ordinary herbaceous plant with a perennial root-system. Also even if it tapped an equal area it would need to take in salts much more quickly to make up for the shortness of its growth-period. This seems to indicate that the aid of a mycorhiza would be particularly valuable, as a more effective and much less costly method of obtaining salts, than the production of a very elaborate root-system. Dicotyledons have a root-epidermis (climacorhizic, type of Van Tieghem) while Monocotyledons are characterised by the *absence* of such an epidermis (liorhizic type). The point upon which I wish to lay stress is that the absence of epidermis in the roots may conceivably facilitate the entrance of the fungus, and this character (though it may have arisen independently, and have been simply utilised in this connexion) might possibly have been evolved in connexion with the mycotrophic habit of life. Its retention in such specialised Monocotyledons as the Gramineæ, which have become strong transpirers and have given up the mycorhiza, would then be explained merely as a hereditary trait which has survived, although its original purpose is lost.

A. R.

THE VEGETATION OF THE SCOTTISH HIGHLANDS[1].

WE know of no more interesting and attractive general account of the vegetation of a country than the present work by Mr. Hardy of University College, Dundee. As its title implies it is no more than a sketch of the leading features of the vegetation. The writer passes quite lightly over the different plant-formations met with, some of which have already been closely studied by R. and W. G. Smith, but his broad general standpoint, and the different points of view from which he surveys the vegetation, furnish the reader with a most illuminating *coup d'œil*.

[1] Esquisse de la géographie et de la végétation des Highlands d'Ecosse, par Marcel Hardy. Paris, 1905.

THE PLANT CELL:

AN HISTORICAL SKETCH.

BY

AGNES ROBERTSON, D.Sc.

(*Reprinted from 'The Naturalist,' June 1906.*)

A. BROWN & SONS, Ltd., London, Hull, & York.

1906.

Marquette, W. Note concerning the discovery of the nucleus. Bot. Gaz. Vol 51 pp 481–463, 1911

Meyen, F. J. F. Ueber das Leimen Spirogyra Lk., und über die Bewegung und Metamorphose der Sp. princeps insbesondere. Linnaea 2. 428. 1827

clearly describes the nucleus of Spirogyra, — he does not seem to have interpreted it as a nucleus.

13

THE PLANT CELL: AN HISTORICAL SKETCH.

AGNES ROBERTSON, D.Sc.

Cytology, the study of the cells, or elementary units of which all living things are built up, is a comparatively young science, dating back less than three centuries. Some branches of botany are comparatively independent of special methods of observation. For instance, the systematic botany of flowering plants may well be studied with no external aids at all; with Cytology on the other hand the case is quite different. We can have no knowledge whatever of cell structure without the aid of lenses, and each fresh development of the subject has had the way paved for it by some fresh development in optics. Some of the first observations with magnifying glasses of which we have a record are those of the Dutchman Leeuwenhoek (1632-1723) who examined an infusion of pepper with the aid of lenses, and saw minute living creatures swimming in it. Many people were sceptical about Leeuwenhoek's results, to his great indignation. 'I have often heard,' he says, 'that many persons dispute the truth of what I advance in my writings, saying that my narratives concerning animalcules, or minute living creatures, are merely my own invention. . . . For my own part, I will not scruple to assert that I can clearly place before my eye the smallest species of these animalcules concerning which I now write, and can as plainly see them endued with life, as with the naked eye we behold small flies, or gnats sporting in the open air, though these animalcules are more than a million degrees less than a large grain of sand. For I not only behold their motions in all directions, but I also see them turn about, remain still, and sometimes expire; and the larger kinds of them I as plainly perceive running along as we do mice with the naked eye. Nay, I see some of them open their mouths, and move the organs and parts within them; and I have discovered hairs at the mouths of some of these species, though they were some thousand degrees less than a grain of sand.' In justice to Leeuwenhoek, I ought to explain that when he uses the size of a 'grain of sand' as a term of comparison, it is by no means as vague as the size of a 'lump of chalk!' In the days when hour-glasses were universal, the different qualities of sand were most carefully sifted, and our author explains somewhere

Some Points in the Morphology of Phyllocladus alpinus, Hook.

BY

AGNES ROBERTSON, D.Sc.

Quain Student in Botany, University College, London.

With Plates XVII and XVIII.

I. Introduction.

PHYLLOCLADUS is a peculiar and isolated genus belonging to the Taxaceae, and characterized by the reduction of its true leaves to pointed scales, and the expansion of certain of its stem-branches into flattened leaf-like structures. Pilger in his monograph of the Taxaceae [1] places the genus in a sub-family by itself, intermediate between Podocarpoideae and Taxoideae. There are six species confined to New Zealand, Tasmania, and the Indian Archipelago. The isolated systematic position of the genus, its restricted distribution and curious external morphology, added to the fact that little was known of its anatomy or development, suggested to Prof. F. W. Oliver that it might prove an interesting subject for investigation. Accordingly, through the kindness of Dr. L. Cockayne, who had access to *Phyllocladus alpinus*, the Celery Pine of New Zealand in cultivation in the Christchurch Botanic Garden, five gatherings of material were sent to University College during the years 1902, 1903, and 1904, and were handed to me for examination. The following account is based upon this material, supplemented by a supply of the vegetative organs of two other species, *P. rhomboidalis* and *P. trichomanoides*, which Mr. R. I. Lynch, M.A., was so kind as to obtain for me from the Edinburgh Botanic Garden, and which has been very useful for comparison. The material of *P. alpinus*, which was fixed in methylated spirit, was unfortunately inadequate for anything like a complete investigation, and it is greatly to be desired that some one who has access to the genus in its native haunts should give us an exhaustive account of its morphology. I am much indebted to Prof. Oliver for his kind help and advice throughout the work.

[1] R. Pilger, Das Pflanzenreich, iv, 5, Taxaceae, 1903.

[Annals of Botany, Vol. XX. No. LXXIX. July, 1906.]

The 'Droppers' of Tulipa and Erythronium.

BY

AGNES ROBERTSON, D.Sc.

Quain Student in Botany, University College, London.

With Plates XXXI and XXXII.

I. Introduction.

In the course of Miss Ethel Sargant's examination of monocotyledonous seedlings, she noticed in the Tulip and Dog's Tooth Violet the peculiar descending stolons known to gardeners as 'droppers.' These seemed to show features of some interest, and since the question lay outside the main line of her research, she proposed to me early in 1902 that I should find out what work had been done on the subject and try to investigate it further. I am indebted to Miss Sargant not only for suggesting this research, but also for handing over to me her *Tulipa* and *Erythronium* seedlings, and allowing me to examine her preparations of these genera. I have also to thank Mr. R. I. Lynch, M.A., of the Botanic Garden, Cambridge, and Mr. E. Aveling Green, of Berrystead, Beds, who have been most generous in supplying me with material and information. This investigation has been carried out in the laboratory of University College, and I have much pleasure in acknowledging the kind help I have received from Professor F. W. Oliver, especially in connexion with the literature.

II. The Movements of Bulbs in the Soil.

(a) *Migration.*

A great drawback of the vegetative reproduction so characteristic of bulbous plants is that it tends to overcrowding. The lateral bulbs are produced close together, and have no opportunity of colonizing fresh soil. This is got over in certain special cases by the replacement of sessile by stalked bulblets. De Vriese[1] records cases in which *Ixia lutea* and *carminosa* produced their lateral bulblets at the end of stalks from 1 to 15 centimetres

[1] W. H. de Vriese, Bydrage tot de Morphologie der Bollen, Tydschr. v. Natuurlyke Geschiedenis, Leiden, 1841.

long. Tristan [1] mentions that stalked bulblets occur in *Allium vineale*. Some Snowdrops (*Galanthus nivalis*), sent me by Mr. Aveling Green, show a similar adaptation in a very striking fashion. In *Galanthus* the growth is monopodial, the flower being produced laterally, and in these specimens the axis had elongated greatly, carrying the new bulb some little distance from the parent (e.g. Fig. 1). Mr. Aveling Green tells me that 'where they have been growing for some years in a mass, the under ones have tried to get along under the mass, and to find a way up and form a second bulb.' I have also seen exactly the same elongation of the axis in a specimen of the Snowflake (*Leucojum aestivum*), by which the new bulb was carried upwards until its base was 5·5 centimetres above the base of the parent bulb. After examining it, I came across a figure and description by Irmisch [2] of a precisely similar case in another species, *L. vernum*.

(b) *Descent.* ✶

To each perennial plant a certain definite depth in the soil appears to be specially appropriate, and if it is disturbed it makes efforts to return to this particular level [3]. Massart [4] records a most interesting series of culture experiments on about 200 perennial species, which were planted, some at the normal level, some too deep, and some too shallow. The plants were very successful in bringing back their winter buds to the normal level by curvature of rhizomes, elongation of internodes, and so on.

To bulbous and tuberous plants a certain depth in the soil must be even more important than to ordinary perennial species, since they want protection for their succulent tissues from animals and from frost. The need for descent into the soil is especially urgent in the case of the seedling, since here the young plant starts at the surface of the ground instead of at the level of the parent bulb or corm. The commonest method of descent into the soil is by means of contractile roots [5], which are shown specially well in the *Crocus*. Here, as each successive daughter corm is formed above the parent, the need for descent is particularly obvious. The contractile root is 'always present in the young seedling, and occasionally reproduced in after years. . . . I fancy I have noticed it to be found more frequently in old Crocus bulbs when they have been brought near the surface in the process of digging a bed.' [6] The contractile roots of *Scilla*

[1] M. de Tristan, Histoire des developpemens de quelques gemmes bulbifères, Mém. du Mus. d'Hist. Nat., 1823, T. x, p. 51.

[2] M. Irmisch, Zur Morphologie der monokotylischen Knollen und Zwiebelgewächse, Berlin, 1850, p. 101, and Pl. VII, Figs. 10, 11, 12.

[3] F. W. Oliver, The Depth in the Soil at which Plants Occur, Jr. Roy. Hort. Soc., April, 1898, vol. xxi, p. 486.

[4] J. Massart, Comment les plantes vivaces maintiennent leur niveau souterrain, Bull. de la Soc. Roy. de Bot. de Belge, T. xli, 1902–3.

[5] C. Wolley Dod, Gardeners' Chronicle, 1886, p. 626.

✶ Secabo Rimbach. Bot. Gaz. 1900 1902

have been investigated by Mr. Woodhead [1], both as regards their behaviour and internal structure.

Among the Lilioideae we meet with a great range of bulb structure. Perhaps the most primitive type of bulb is that of such a plant as the White Lily, in which the scales are obviously leafy, the outer ones being actually formed from the bases of the foliage leaves. A slightly more advanced stage is reached in the Turk's Cap Lily (*Lilium Martagon*), in which there are no ground leaves, and so all the bulb leaves, not merely the inner ones, take the form of specialized scales. A much more sophisticated type is that of the so-called 'tunicate bulb,' in which each scale leaf is a closed sheath, with only a small opening at the top. The most specialized methods of descent into the soil with which we are acquainted are met with in *Scilla*, *Tulipa*, and *Erythronium* among the Lilioideae, and *Gagea* among the related Allioideae, all of which have tunicate bulbs. The curious behaviour of the Wild Hyacinth is described by Rev. C. Wolley Dod as follows:—'The smallest bulbs, which I take to be the produce of the seed shed eighteen months before, in the July of the previous year, are at a depth of one or two inches, and the size of a small pea; the two-year-olds are at an average depth of four inches, and at least 70 per cent. of them are curiously elongated, being three times as long as broad. Those three and four years old—for I think some rest contented with the depth reached in the third season's growth, and some take another dive in their fourth season—are six or seven inches deep. Thus the crown of the new bulb is, on an average, 1½ inch below the base of the old one, and I feel no doubt that it is formed where it is found.' Mr. Woodhead [1] has published a full and interesting account of the life history of the Wild Hyacinth, and the structure of the curious elongated bulbs by which it lowers itself into the soil.

The most highly specialized method of descent, that by 'droppers,' is discussed in detail in the following sections.

III. Tulip 'Droppers.'

Tulip growers have long been familiar with 'droppers' ('sinkers' as they are called in Holland), and a good many accounts of them and references to them occur in horticultural and botanical literature; but it will be convenient to leave the discussion of these until after the description of my own observations.

(a) *The Non-Flowering Tulip.*

Fig. 2*a* shows a typical, immature, non-flowering plant of *Tulipa saxatilis*, in the state in which it would be found about March. The

[1] T. W. Woodhead, Notes on the Bluebell (*Scilla festalis*, Salisb.), The Naturalist, Feb. and March, 1904.

THE TAXOIDEÆ:

A Phylogenetic Study.

By AGNES ROBERTSON.

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THEORIES OF EVOLUTION:

AN HISTORICAL OUTLINE.

BY

AGNES ROBERTSON, D.Sc.

(Reprinted from 'The Naturalist,' May, June, and July, 1907.)

A. BROWN & SONS, Ltd., London, Hull, & York.

1907.

PRICE SIXPENCE

My botanical history (Agnes Arber. Notes made in 1916)

When I was seven years old I stayed at Reedgrick with my grandmother (Agnes Turner) & Aunt Mary. My grandmother was very fond of flowers & plants & under Aunt Mary's supervision I made a collection of pressed flowers headed in round hand "Agnes aged seven". But I do not remember any definite interest in plants being aroused in me by this. This came later, & at one special moment, when we had a lesson from one of the teachers at the N.L.C.S.G. (probably Miss Bickham, but it might have been Miss Bartholomew) on the flower of the Hawthorn. I remember that the idea that all that beauty & interest existed inside a flower was a perfect revelation to me. I was certainly not more than 12 years old at the time & probably younger. In Dec 1892 when I was 13 years old Massee's little popular book "Plant Life" was given to me, & I still have the notes I made from it at the time. It fascinated me completely & I saw there for the first time a picture of a cell & a nucleus. Miss Aitken's lessons before the Junior Cambridge Local which I took in 1893 gave me my first ideas of plant anatomy. In 1894 I wrote a monograph of the Ivy leaved Toadflax for a holiday task, & to my great pride it was published in the School Magazine in November 1894 with a full page block of illustrations. This was, in its tiny way, [illegible] & though naturally my observations were not "new to science" [illegible]. In 1894 father had a copy of Lyte's [illegible] the engraver's widow who was obliged to realise her books in the house for a few days & opened my eyes to the glories of the old herbals. I still have the notes I made from it at the time. This led to the paper on Herbals which was my presidential address to the Newnham Coll. Nat. Sci. Soc. in 1901, & ultimately to a paper on Herbals in the Pop. Sci. Monthly (No 4 in this book) & then to my book on Herbals (Camb. Univ. Press 1912).* Twice while I was at School Miss Ethel Sargant, who was a great friend of Miss Aitken's, came to read a paper to the Science Club. The first time (in) when Gabrielle Matthaei & Eva Blythe were the leading science girls, I was asked to tea with the Committee & Miss Calkin & Miss Sargant afterwards. I was tortured with shyness, but so anxious to meet "a real live researching botanist" that I shamelessly stayed to tea, though I was due at a music lesson at Miss Calkin's! I remember now how lame my explanation sounded when I did eventually reach Miss Calkin. The second time Miss Sargant came was when I was secretary of the Science Club & through my report of her speech & my correspondence about it (it was about the pollen grains etc of Lilium martagon) my friendship with her (which has been the greatest influence & good fortune in my botanical life) came into being. I cannot possibly express what I owe to her.

* In this year, 1894, which was the year of my real growth [illegible] to Botany, I also began a book of Botanical Notes & cuttings [illegible] which has since come in useful in [illegible] popular [illegible]

This second summer meeting led to Miss Sargant's asking me to come to Reigate in the summer of 1897 for some weeks when I was 18, to prepare for College. Miss Sargant put me through practical work illustrating Scott's "Flowering Plants" & also gave me a little "research" to do on the seedling structure of the melon. From 1897 to 1899 I was at U.C. ~~[illegible]~~ I went to lectures by ~~Seward~~, F.W. Oliver & A.G. Tansley. In 1899 I went to Newnham where I went to lectures by Seward, F. Darwin & ~~[illegible]~~ (in palaeobotany) E.A.N. Arber. Seward gave me a piece of research to do on the anatomy of Macrozamia which I finished in 1902 before my Part II (No. 2 in this book). In the summer of 1901 I again worked at Reigate & learned microtoming. From 1902–1903 I was Miss Sargant's research assistant at Reigate where I worked chiefly on the anatomy of grass seedlings (see No. 8 in this book & No. [illegible] in next book). From 1903–1909 I was at University College again, & the papers 5, 6, 9–17 in this book date from there. After the date of the last of these & before my marriage I worked at the seed Mitrospermum (see No 1–2 in next book) & I also started a general examination of stamen anatomy that led to no general results but to the papers (Nos 4 & 11 next book) developed after my marriage. From the time I came back to Cambridge Newell had a very good influence on my work, — chiefly in his unrivalled knowledge of the literature & in his war against vagueness & drifting. My Herbal book took me from Oct 1910 to [illegible] the autumn of 1912, though of course I was doing [illegible] at the same time. The Water Plant book, on [illegible] was begun on Newell's suggestion, in [illegible] which I am still working [illegible] July 1910. The Statistics work came [illegible] association with Mr Beer who asked me to collaborate with him in February 1915. I should have mentioned before the Lepidostrobus paper which was done under Newell's direction, in the Sedgwick Museum, & though outside my real scope, was of great value to me as discipline in another, & very critical, branch. The paper on Nehemiah Grew in Makers of British Botany was a further development of the early paper on the same subject (No. 13 in this book) & this together with my papers in "Isis" on Guy de la Brosse, will form, I hope the basis of a book which I think of calling "Studies in Seventeenth Century Botany". In cutting sections for the multinucleate cell work I came on the inverted bundles of Eremurus leaves. This started me 18 years on the phyllode theory which I first thought of at Reigate in 1902–3. This resulted in my 1918 general paper on the Phyllode theory. The sections cut for this & the mult. cellwork put me on to the cambium in Monocotyledons subject, on which I have done a series of three small papers.

In the phyllode paper I feel for the first time that I have really "found myself"...

1919 The water plant book which was finished & finally taken to the Press on May 1. 1919 (i.e. within ~~a couple of~~ three months of 8 years from Newell's first suggestion) led me to the idea of the Law of Loss (see paper in this & [illegible] in 1919.) I have undertaken to do the book on Monocotyledons for the Cambridge Press. I am now greatly absorbed in development of the phyllode theory (see Smilax, Bulbs, Leaf base Phyllodes, Bulbs, Pistia & Lemnaceae Proc. Roy Soc.)

I really feel that this is my métier, & for the first time since I began research I have felt — since the summer of 1917 (i.e. 15 years after I first began research) — that I have got onto my real path & see vistas of work in this connexion. Before the Phyllode paper work began I was always hopping about from one thing to another: as soon as I had done a job, I wanted to do something quite different for the next, whereas now I feel I want just to go on developing & working out the Phyllode theory & the things related to it.

I feel now a great development in the part played by my subconsciousness in my work, & also a much greater mental tenacity in the pursuit of ideas.

In the last year I have spent some time, in connexion with Dr Charles Singer, on Medieval MS herbals. But tho' this is very great fun, I feel it is rather waste of time — not the real thing.

Balfour Laboratory. I believe I first began research in the Balfour Laboratory in October 1910, & moved to my corner place (Miss Durham's former) in October 1912.

My mother's mother was fond of plants & was a friend of Miss Pluess who wrote popular botany. On the other side, my father when a boy made great efforts — without help or encouragement — to study the British Flora. His father, who had died young, must I think have had some interest in botany for I have a copy of the Flora Britannica* inscribed "Presented to Mr Thos. Robertson by David Don" — such an interview would not be unlikely, as Thos Robertson was a Scotch gardener. On my mother's side there were some scientific leanings: George Fownes, FRS the chemist was a 1st cousin of her father's, & Davidson the African explorer was a great uncle of hers.

1921. I have continued steadily at developments of the phyllode theory for the last 4 years & have still further work on it in prospect.

* So labelled on binding, but it is really Hull's British Flora