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I. Contributions to Microscopical Analysis. No. 2. *Celastrus scandens*, Linn., with Remarks on the Colouring Matters of Plants

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forwarded to Calcutta for despatch to Madras ; but it seems to have been appropriated for use in the School of Arts in Calcutta, where a prize of 500 rupees was offered for the best substitute for English boxwood fit for engraving. We do not yet know if the prize has been awarded, but we heard from a friend who had lately visited the School of Arts in Madras and Calcutta, that a good deal of boxwood has been sent to the latter school, and our log is one of those probably. We should think the prize of 500 rupees too large for such a discovery in Madras, as we have collected all the above-named woods, and used some of them for engraving and illustrating scientific and educational books, reports, and many of the advertisements in the Madras newspapers, and all have been the result of a reward of 10 rupees offered to Captain Puckle who sent us the best collection of woods, and who liberally handed over the reward to the natives who collected the specimens. We have to deplore the loss of the services of our best wood-engravers in Madras. Mr Garrick, who was at the head of this department, has been tempted away from us to Calcutta with the offer of a high salary. Mr J. Duarte, Mr Sharleib, and many others who used to render us valuable aid, have obtained more remunerative employment for their talents than we could afford to give, and we are reduced to one intelligent deaf and dumb native lad, who promises as well as any of the above named.

We have still got a good staff of engravers and etchers upon copper. This style of work was pointed out to us in England as one in which the natives of India were calculated to excel, as it admits of a free and flowing kind of line which cannot be easily imitated in wood engraving. We wish our former teachers and pupils every success in after life, and should be glad to see them trying to aid in the extension of a taste for the fine arts, or for illustrating literature in Southern India. A good many lads began to learn wood engraving in Madras, but few of them had the perseverance to carry it on, chiefly, I believe, on account of its difficulty, and the time and labour required to be expended on its study.

8th March 1860.—Professor BALFOUR, V.P., in the Chair.

The following donations were announced to the Herbarium :—

Specimens of *Tephrosia toxicaria*, var. *Schiediana* (Sch.), from Dr W. H. Campbell, Demerara. The plant had been sent to Dr Campbell as being used by the negroes in one or more cases of poisoning, which had lately occurred near Georgetown, Demerara.

Specimens of *Cuscuta Epithymum*, from Penmanshiel, sent by Mr James Hardy. Mr Hardy says—"It was confined to one spot in a field which is under tillage for next year's crop, so that it may disappear. The soil was originally reclaimed from a state of nature ; and whether it was attached to the wild thyme or heather that once grew there, or has been introduced with cloverseeds, I cannot ascertain. The dodder is a new plant to

Berwickshire, for the specimen mentioned in Dr Johnston's Flora was found on the lower range of the Cheviot Hills in Northumberland."

The following donations to the Museum at the Botanic Garden were announced:—

From Messrs P. Lawson & Son—Cones of *Cedrus Atlantica* and *Cupressus macrocarpa*; also specimens of *Juniperus tetragona*.

Dr Macfarlane, Montego Bay, per Dr Douglas MacLagan—Hammock and ropes, prepared from fibres of lace bark tree (*Lagetta lintearia*).

The following communications were read:—

- I. *Contributions to Microscopical Analysis*. No. 2. *Celastrus scandens*, Linn., with *Remarks on the Colouring Matters of Plants*. By GEORGE LAWSON, Ph.D., Professor of Chemistry and Natural History in the University of Queen's College. Canada. Communicated by Professor BALFOUR.

Two years ago, viz. on the 10th December 1857, I read to the Botanical Society the first of a series of papers on the Microscopical Characters of Vegetable Substances. My intention was to bring before the Society, from time to time, such of the more important drugs and articles of food as had escaped the notice of other histologists, as well as to supply from observations such omissions, and correct such inaccuracies as seemed to obscure previously published descriptions. My departure from Edinburgh interrupted the continuation of the series. I now propose to resume it. Instead, however, of selecting substances from the British markets and the Botanical Museum, I shall rather give the results of a histological examination of some of our more important Canadian plants, especially those species whose properties render them useful in medicine or the arts.*

On the present occasion, I select for remark one of our

* An abstract of my former paper on this subject will be found at p. 25; also in the "Edin. New Phil. Jour." vol. vii., new series, p. 315.

most ornamental Canadian plants, *Celastrus scandens*, Linn., chiefly on account of an interesting structure observable in the colour-substance of the arillus, which presents a very distinctive histological character. This is one of the most conspicuous plants which attract the attention of autumn visitors to the Falls of Niagara; for although its flowers are small and greenish, the fruit-clusters are large, and showy in their colouring. The fruit is globose, of a very bright orange colour, and opens (usually by three, sometimes two or four valves) to display a deep scarlet-coloured pulpy mass, consisting of the arilli, in which the large brown seeds are enveloped.

There is a good description and figure of the plant in Gray's "Illustrated Genera of United States Plants," vol. ii. p. 185, plate 170. See also "Persoon, Synops.," i. p. 242; "Hook. Fl. Bor. Am.," vol. i. p. 120; "Torrey and Gray, Fl. N. Am.," vol. i. p. 257; and "Gray's Man. Bot. N. States," p. 81. The plant goes under the common names of climbing staff-tree, Virginian wax-work, and shrubby bittersweet. It was introduced into England from America, so long ago as the year 1736, by Peter Collinson (Col. MSS. in "Hort. Kewensis," 2d edit. vol. ii. p. 26).

In regard to its properties, the seeds of this species are said to be narcotic and stimulating (Gray, *l. c.*); and most authors agree in attributing emetic and purgative properties to the bark (see "Balfour's Class Book," p. 794.) It must be confessed, however, that a certain amount of dubiety attends some of the published statements of the properties attributed to this plant. The fullest indication which I meet with is perhaps that contained in few words in "Lindley's Vegetable Kingdom," 3d edit. p. 587, and that indication is by no means so satisfactory as could be wished. After observing that the seeds of the European species of *Euonymus* (which also belong to *Celastraceæ*) are nauseous, and said to be purgative and emetic, that sheep are said to be poisoned by them, and that an ointment was formerly prepared from them for the destruction of pediculi in the head, Dr Lindley proceeds to state, that "similar qualities have been found in the bark of *Celastrus scandens*," &c.

We know that many plants of the order *Celastraceæ* are

by no means inactive, and this circumstance ought to induce a more careful examination of the properties of the one before us. Royle states that an active principle has been detected among the Indian species, which acts with more or less activity; several yield an oil which is used in burning. *C. paniculata*, Willd. (*Malkungnee*), yields oil which is both useful for burning and in medicine. It is highly valued by the native practitioners in India, and is employed in the disease called *Berri-berri*; it is described as having a bitter and acrid taste. I find oil in the cells of the copious albumen of the seeds of *C. scandens*. The beautiful light-yellow inner bark of *Euonymus tingens* is said to be useful in diseases of the eye, and to be used also to mark the tika on the forehead of Hindoos; its use as a dye has been suggested. I also find it mentioned by Lindley and others, that the leaves of *Catha edulis*, the kat or khât of the Arabs, have stimulant properties, which, it is said, cause in those who eat them extreme watchfulness, so that a man may stand sentry all night long without drowsiness. The Arabs are fond of these leaves, and have faith in them as an antidote to the plague; Botta says that, when fresh, they are very intoxicating. The species of *Elæodendron* yield a drupaceous fruit, which is in some cases eatable, as in *E. Kubu*, whose drupes are so used by the colonists of the Cape of Good Hope, while the fresh bark of the root of *E. Roxburghii*, rubbed with water, is employed by the natives of India to allay swellings; it is, says Roxburgh, a very strong astringent. The wood of plants belonging to this order also has its special uses. That of *Celastrus serratus* is charred in Abyssinia for cannon gunpowder (Richards), whilst that of *Euonymus europæus* is used for the same purpose in France; the charred young shoots find a more peaceful application in the artist's hands.

As I have already indicated, the chief point of interest in the histological structure of *Celastrus scandens* is found in the tissue of the arillus, which presents a kind of colouring matter of which we as yet know but few examples in the vegetable kingdom. That we may fully appreciate this peculiarity, let us, in the first place, refer to the conditions under which colouring matters usually exist in plants. The green

colouring matter (chlorophyll) of leaves and other green parts, occurs almost, if not quite, constantly in the form of insoluble granules, which are usually well defined, and most commonly more or less globose. The yellow colouring matter of flowers also frequently exists in the form of granules, but often also dissolved in the cell-sap. The red and blue colouring matters on the other hand are almost always diffused in a state of solution in the cell-sap. But while all this is true as a rule, exceptions occasionally present themselves. If, according to Mohl, the reported presence of green-coloured cell-sap in plants is due merely to imperfect observation, we at least know that amorphous chlorophyll does occur, and it likewise seems probable that in many cases the apparently large and well-defined granular aspect of chlorophyll is dependent upon the association with it of starch granules. Exceptions to the usual character of the red and blue colouring matter in flowers occur in the case of *Salvia splendens* and *Strelitzia Reginae*.* In the latter plant, both the blue and yellow colouring matters are peculiarly interesting, of which I recollect to have exhibited preparations to the Botanical Society some seven or eight years ago. This is one of the few plants in which we have striking examples of the occurrence of colours belonging to both the xanthic and cyanic series in one flower. We have here a peculiarly rich blue, or violet blue, associated with a peculiarly rich orange-yellow. But it is the histological condition of the colouring matter that I wish especially to refer to. In the blue parts of the perigone, the colouring matter in the cells consists entirely of spherical granules of an intense blue or violet-blue colour; occasional cells contain similar shaped granules of bright crimson or rose-colour. The granular character of the colouring matter is quite constant, but is apt to be overlooked if the fully expanded or old flowers are selected for examination. It is best seen in the tissue, long before the expansion of the flower. The spathe containing flower-buds should therefore be cut open so soon as it is perceived rising up from the rhizome, at the base of the leaf-stalks; even at that stage, before they have been exposed

* See "Mohl's Principles of the Anatomy and Physiology of the Vegetable Cell," Henfrey's Edition, page 44.

to light, the parts of the perigone will be found to have acquired their deep golden and azure hues (although they are not so brilliant as they afterwards become), and the globular granules are seen distinctly in the cells, the edges of which present the peculiar crumpled appearance so common in the colour-cells of flowers. When the flower attains maturity, the cell usually becomes completely filled up with granules, which then present the aspect of a dense homogeneous mass of opaque blue matter, in which the granular character cannot be distinctly seen: this effect is heightened when some of the granules become broken up. Even in the mature flower, however, some cells may usually be found containing fewer granules, and in these the granular character of their contents may be observed without difficulty.

In the yellow parts of the perigone, instead of spherical granules, we find the colouring matter in the form of *filaments*, which are spirally twisted and rolled up in various ways in the cell, resembling, to some extent, in their twisting the delicate spiral fibres in the cells of the aërial roots of epiphytal orchids. But the fibres are in many cases very short, and form small round coils, which, under a low power of the microscope, give the outline of globular bodies, resembling the nuclei of many plants.

To these examples of abnormal colouring matter I have now to add the pulpy arillus of *Celastrus scandens*, which, although of a different colour, strongly reminds me, in its histological characters, of the yellow parts of the perigone of *Strelitzia*. In the *Celastrus* the arillus consists of more or less elongated oblong cells, whose membranes are colourless and quite transparent. The colouring matter is contained in these cells, and presents itself in the form of numerous minute elongated granules, exhibiting well-defined outlines; they present considerable uniformity both in size and shape. They are slender, between linear and laneolate in form, and either acute or more or less acuminate at both ends. They are for the most part straight, but in some cases curved, more or less perfectly, into a crescent, and, more rarely, the curvature is so great that the two extremities meet, and then the granule assumes the form of a ring. These granules are all of a uniform bright scarlet

colour. They are frequently aggregated in masses in the cells. Usually, however, they are quite separate, and lie without order in the cell; crossing each other in various directions. In narrow, elongated cells, whose diameter is less than the length of the contained granules, the latter are usually arranged conformably, lying in the longitudinal direction of the cell, just as we find in the case of the raphides which occur in elongated special cells in endogenous plants. On an average, the colour granules measure the two-thousandth part of an inch in length, by the twelve-thousandth part of an inch in breadth, being thus about six times as long as broad. The cells in which the granules are contained are somewhat variable both in size and form. When quadrangular, and not much longer than broad, they measure about the six hundred and seventieth part of an inch in diameter; but in cases where they are much elongated, their breadth is proportionately decreased, as is usually the case in parenchymatous tissues.

Under a low power (as, for example, the lowest power of Nachet's microscope), the seed of *Celastrus scandens* also presents a characteristic aspect in its minutely embossed surface, of a fine fawn colour. On increasing the power, it is found that the embossed appearance is dependent upon the slightly elevated surfaces of the cells, which are compact, regular-sized, and sufficiently distinctive of themselves to lead to the discrimination of the tissue from most other vegetable tissues. A cross section of the membrane forming the seed-covering (readily obtained by making a thin horizontal slice of the whole seed), presents a peculiar striated appearance, which is also characteristic enough. The cells of the albumen contain oil.

My remarks on the colouring matters of plants have extended to a greater length than I anticipated; but that they are not foreign to the main subject, viz. the Microscopical Analysis of Commercial Substances, will appear in the course of succeeding papers. Our knowledge of the chemistry of these colouring matters is still very imperfect. Chlorophyll is not known in a state of purity, and the changes of colour which it undergoes have been only partially explained. By Fremy and Cloez the colouring matters of flowers are referred

to three distinct substances, two of which are yellow, while the other is of a blue or rose colour. The blue or rose colour is produced by a compound which has been termed *Cyanine*, the blue tint becoming red when exposed to the action of an acid. The yellow matter, which is insoluble in water, is termed *xanthine*, and that which is soluble has received the name of *xantheine*. These bodies, however, have not been isolated in a pure condition; and some of the facts above recorded indicate at least a probability that three such bodies are insufficient to account for all the observed phenomena of flower-colouring.

II. On *Trichotomous Arrangements of Plants*. By Mr WILLIAM MITCHELL, Associate of the Botanical Society.

Mr Mitchell remarked that in the classification of natural objects, of which our knowledge is limited, it is desirable to have the divisions capable of embracing all that the progress of discovery may make known. This advantage, however, we cannot easily gain unless it is in our power to make use of the number, position, presence or absence, of parts or organs as essential characteristics in our comparison of the objects in question. But on glancing over the more common classifications of plants, we find cases admirably illustrative of scientific tact in seizing hold of such leading characters as render the divisions all-embracing in their own provinces; and singularly enough these divisions generally come out in threes. A principle of arrangement was thus struck out, which was partially employed by Ray; but clearly enunciated by Jussieu, when he ushered in that grand and ever-memorable ternary of the *Dicotyledonous*, *Monocotyledonous*, and *Acotyledonous* plants. He could now pass at once to the flowering plants, and produce another trichotomous arrangement in the same manner; which he did in his *Polypetalæ*, *Monopetalæ*, and *Apetalæ*. Mr Mitchell then proceeded to illustrate his remarks by various instances of trichotomy in the vegetable kingdom.

III. On *Disease of the Nutmeg Trees in Singapore*. By Mr ANDREW T. JAFFREY.

Mr Jaffrey has recently examined the nutmeg plantations of Penang and Singapore, and states that "there is a real possibility of ruin staring the proprietors of the plantations in the face, and the chances are that, unless remedial measures are adopted to arrest the present deterioration of the trees, which is almost universal, there is a probability that there will be the extinction of a valuable article of commerce. It was perfectly evident, when visiting the islands a few months ago, that some fatal malady had seized upon the trees. The cause of this effect may be difficult to discover, but, judging from appearances only, the conclusion came to was that the disease was *local*, and not *constitutional*; therefore there was a hope that it would be overcome." There was a yellow sickly appearance of the foliage, the branches here and there showed symptoms of decay, and