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Dr. Augustus Voelcker

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Wheat has been opportunely checked.

The land is generally in fine condition for the spring crops.

The impetus given to draining has kept the agricultural labourers well-employed during the winter.

Cattle, where healthy, have done well; but they as well as sheep have suffered from epidemics.

From Nottingham, favoured by E. J. Lowe, Esq., F.R.A.S.

Wheat looks very promising, and the grass in fields from present appearance will be early. Apricots are nearly all destroyed by frost, and gooseberries and currants injured. There is a great bloom of plums, cherries, pears and apples. Peaches and nectarines have been slightly injured by frost.

[For the monthly values of the several subjects of research, the names of the observers, and particulars of instruments used, see the Registrar-General's Quarterly Report.]

XLV. *On the Watery Secretion of the Leaves and Stems of the Ice-plant* (Mesembryanthemum crystallinum, *L.*). By Dr. Augustus Voelcker, Prof. of Chemistry Royal Agricult. College, Cirencester*.

A FEW months ago I had the pleasure of communicating to the Botanical Society of Edinburgh the results of an examination of the watery liquid in the ascidia of *Nepenthes destillatoria*. Those present at the meeting, as well as the readers of the 'Philosophical Magazine,' will remember that, in opposition to the statements of most botanists who have directed their attention to the subject of the watery secretions of the leaves of plants, I found the liquid in the ascidia of *Nepenthes* to differ materially from pure water, inasmuch as it contained from 0·30 to nearly 1 per cent. of solid substances, partly organic partly inorganic. I stated at that time my doubts as to the watery secretion of plants being nothing but pure water, and gave some reasons for this opinion; Prof. Balfour, with whom I discussed the subject, kindly furnished me with the means of investigating this point still further by favouring me with fresh specimens of the curious Ice-plant (*Mesembryanthemum crystallinum*), a plant which is remarkable on account of the gland-like vesicular eminences with which its leaves and stems are covered. The result of the examination of the fluid secreted by the leaves of this plant has fully confirmed the opinion expressed in regard to the watery secretions of plants; at all events it has shown me that the secretion of the leaves of the Ice-plant is not merely pure water, but water containing several substances in solution. Though I was unable to determine quantitatively the composition of this secretion on account of the small quantity of liquid at my command—a quantity insufficient

* Read before the Botanical Society of Edinburgh, Jan. 10, 1850.

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even for a minute qualitative analysis—yet I had no difficulty in detecting the chief constituent parts of the fluid. The secretion I procured by lacerating the gland-like eminences with which the leaves are covered, with a needle, and collecting the fluid in a glass bottle. The fluid thus obtained was colourless and nearly clear, without smell, and possessing no distinctly pronounced taste. Litmus-paper dipped in it was very slightly turned red, showing the presence of merely traces of a free acid or an acid salt. In order to free it entirely from any particles of epidermis which might accidentally have mingled with the liquid, I filtered it through white filtering-paper. The fluid passing through the filter slowly was now perfectly clear. On heating to 212° F. white flakes were separated, which proved to be identical with vegetable albumen. They were collected in a filter, and the filtrate evaporated to dryness on a water-bath. During the evaporation the liquid turned yellow, particularly when evaporated to a small bulk, and left a brownish-coloured, very hygroscopic residue, which redissolved in a small quantity of distilled water, leaving but a trace of a humus-like, dark-coloured organic substance undissolved.

The chemical nature of the fluid from which the albumen had been separated, was ascertained as far as possible by the following tests:—

Ammonia produced no change.

Carbonate of ammonia gave no precipitate.

Carbonate of soda on boiling gave a white precipitate.

Oxalate of ammonia produced no change.

Phosphate of soda and ammonia, added to the concentrated liquid, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the concentrated liquid after the removal of the magnesia, produced a crystalline yellow precipitate.

The presence of soda was indicated by the yellow colour given to the alcohol flame.

Lime-water produced a white precipitate.

Sulphate of lime likewise produced a white precipitate.

Chloride of barium gave a heavy white precipitate.

Nitrate of silver gave a white flaky precipitate, soluble in ammonia, but insoluble in nitric acid.

Acetate of lead produced a white precipitate.

Basic acetate of lead gave a voluminous white precipitate.

A portion of the water evaporated to dryness and heated to redness left a white ash which effervesced with acids, indicating the presence of carbonates, originated from organic acids present in the fluid.

The nature of the organic acids, which in all likelihood ac-

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companied the oxalic acid, I could not determine from want of material. The presence of oxalic acid however is distinctly indicated by the above reactions. They likewise show the presence of chloride of sodium, potash, sulphuric acid and magnesia.

In comparing this secretion of the leaves of the Ice-plant with the fluid in the ascidia of *Nepenthes*, we find a material difference in their respective compositions, as will be seen by the annexed table, which exhibits the composition of both fluids:—

Composition of the fluid in the ascidia of Nepenthes.	*Composition of the watery secretion of the leaves of* Mesembryanthemum crystallinum.
Organic matter, chiefly malic and a little citric acid.	Organic matter (albumen, oxalic acid, &c.).
Chloride of potassium.	Chloride of sodium.
Soda.	Potash.
Lime.	Magnesia.
Magnesia.	Sulphuric acid.

XLVI. *On the Quaternion Expressions of Coplanarity and Homoconicism.* By WILLIAM SPOTTISWOODE, *M.A., of Balliol College, Oxford**.

THE following investigations relate to certain theorems given by Sir W. R. Hamilton in vol. xxix. of this Journal. Adopting the notation of the original papers, the equation

$$S.\alpha\alpha_1\alpha_2=0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1.)$$

(where suffixes are used instead of accents) is equivalent to

$$\begin{vmatrix} x, x_1, x \\ y, y_1, y_2 \\ z, z_1, z_2 \end{vmatrix} =0, \quad . \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

which may be replaced by

$$a\alpha+a_1\alpha_1+a_2\alpha_2=0; \quad . \quad . \quad . \quad . \quad . \quad . \quad (3.)$$

because, there being no linear relation between i, j, k, this last is equivalent to the system

$$\left.\begin{aligned} ax+a_1x_1+a_2x_2&=0 \\ ay+a_1y_1+a_2y_2&=0 \\ az+a_1z_1+a_2z_2&=0 \end{aligned}\right\} . \quad . \quad . \quad . \quad . \quad . \quad (4.)$$

and (2.) or (1.) is the result of these. Hence (1.) and (3.) are alike conditions of coplanarity.

Again, if

$$\left.\begin{aligned} \beta &=V.V.\alpha\,\alpha_1.V.\,\alpha_3\alpha_4 \\ \beta_1&=V.V.\alpha_1\alpha_2.V.\,\alpha_4\alpha_5 \\ \beta_2&=V.V.\alpha_2\alpha_3.V.\alpha_5\alpha \end{aligned}\right\}, \quad . \quad . \quad . \quad . \quad . \quad (5.)$$

* Communicated by the Author.

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