cell in the y_1 row), and so on across the y_1 row. When computing on a slide rule, this operation involves, of course, alternate movements of cursor and slide. The result is placed in the '+' or '−' column according as the row contains an even or an odd number of *minus* signs. This operation is performed for each row until the '+' and '−' columns have been filled. The '−' column is summed and subtracted from the total of the '+' column to give the required value of $y = Y$. The table is not, of course, confined to four pairs of values, but may be extended in an obvious manner.

A. K. SOPER.

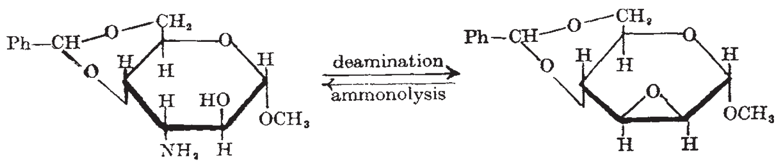
Research Laboratories,
Kodak Limited,
Wealdstone, Harrow, Middx.

[1] Davis, D. S., "Empirical Equations and Nomography" (McGraw-Hill Book Co., 1943), p. 61.

Reversible Conversion of Amino- into Anhydro-sugars

ANHYDRO-SUGARS have already been the subject of diligent study by several groups of workers, and the chief methods of obtaining these compounds have been through the hydrolysis of sulphonic or halogen acid esters of sugar derivatives. For example, 2 : 3-anhydro β-methyltaloside was obtained by alkaline hydrolysis of 2-*p*-toluene sulphonyl β-methylgalactoside[1]; 1 : 6-2 : 3-dianhydro β-talose was isolated after the alkaline hydrolysis of 2-mesyl 1 : 6-anhydro β galactose[2], and 3 : 6-anhydro β-methylglucoside has been obtained by the hydrolysis of 6-bromo β-methylglucoside[3]. Sulphuric acid esters of sugars have also been made to yield anhydro-derivatives. For example, Duff and Percival[4] obtained 3 : 6-anhydro β-methyl glucopyranoside from barium β-methyl glucopyranoside sulphate. Finally, the same type of reaction has been applied to the nitric acid esters of sugars. Gladding and Purves[5] obtained a product which probably contained 2 : 3-anhydro β-methyl-mannoside from 3 : 4 : 6-triacetyl β-methylglucoside 2-nitrate and 3 : 6-anhydro α-methyl-glucoside from 2 : 3 : 4-triacetyl α-methylglucoside 6-nitrate.

Now it has been found that methyl glycosidic derivatives of amino-sugars can very easily be converted into anhydro-sugars of the ethylene oxide type by removal of the amino-group with nitrous acid. Thus, deamination of 2-amino 4 : 6-benzylidene α-methylaltroside results in a quantitative yield of 2 : 3-anhydro 4 : 6-benzylidene α-methylalloside, and deamination of 3-amino 4 : 6-benzylidene α-methylaltroside (I) gives 2 : 3-anhydro 4 : 6-benzylidene α-methyl-mannoside (II). Deamination has, as would be expected, been accompanied by Walden inversion at the carbon atom originally carrying the amino-group. Of course, it is well known that deamination of glucosamine yields an anhydro-sugar, chitose, but this change is not reversible. On the other hand, the change described here is a reversible one, for ammonia will reconvert the ethylene-oxide anhydro-sugar largely into the original amino-sugar derivative.



(I) (II)

The deamination of similar derivatives of the naturally occurring amino-sugars, glucosamine and chondrosamine, is being investigated.

L. F. WIGGINS.

The A. E. Hills Laboratories,
University, Birmingham, 15.
Oct. 18.

[1] Wiggins, *J. Chem. Soc.*, 522 (1944).
[2] James, Smith, Stacey and Wiggins, *Nature*, 156, 308 (1945).
[3] Fischer and Zach, *Ber.*, 45, 456 (1912).
[4] Duff and Percival, *J. Chem. Soc.*, 830 (1941).
[5] Gladding and Purves, *J. Amer. Chem. Soc.*, 66, 76 (1944).

A New Crystalline Plant Virus

AMONG several viruses attacking cruciferous plants is one which affects turnips and, so far as we know, has not been previously described. The main symptom produced on the turnip is a bright yellow and green mosaic mottling, and the name we suggest for the virus is 'turnip yellow mosaic virus'. The host range is rather limited, but Chinese cabbage, *Brassica chinensis*, var. Chihli, is susceptible and reacts to infection with a brilliant white, yellow or green mottling which resembles a variegation rather than a mosaic (Fig. 1).

During studies on this virus we found that, unlike the other viruses attacking Cruciferæ, it was in high concentration in the plant and was infectious at dilutions of 1×10^{-6}. Like most plant viruses which occur in high concentration in their hosts, this virus is apparently not insect-transmitted, although we have some evidence that it may be seed-borne in about 2–3 per cent.

For making the virus preparation, the Chinese cabbage was used and the procedure is as follows. Leaves showing systemic infection are minced unfrozen and the sap is expressed. This is then centrifuged to remove coarse particles, and one third the volume of 97 per cent ethyl alcohol is added. The coarse coagulum which forms contains the virus, and after standing for some hours this is spun down. The clear yellow supernatant liquid is discarded. The green sediment which contains the virus is extracted with 0·5 per cent sodium chloride solution, the volume used being about a third to a half that of the original sap. The suspension is then centrifuged to remove the insoluble plant material. On the addition of ammonium sulphate to one third saturation to the supernatant liquid, the virus is deposited as small crystals.

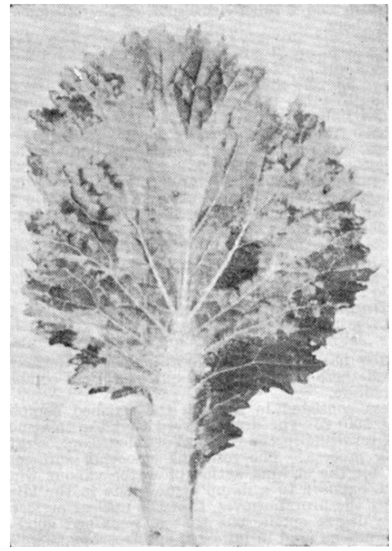


Fig. 1. LEAF OF CHINESE CABBAGE SHOWING THE MARKED MOSAIC MOTTLING CAUSED BY TURNIP YELLOW MOSAIC VIRUS.

After standing for a time to allow full precipitation of the virus, the crystals are centrifuged off at slow speed. They are re-dissolved in a small volume of water and the solution is centrifuged to remove insoluble material. The virus is then re-deposited as crystals by the addition of half a volume of saturated ammonium sulphate solution. The yield is approximately 170 mgm. from 1 litre of sap, and the isolation procedure is unquestionably more simple than that of any other virus, not excluding tobacco mosaic virus.

The crystals of turnip yellow mosaic virus (Fig. 2) are very small, are isotropic and appear to be octahedral. They dissolve readily in water to give a colourless, opalescent solution. As in the case of the viruses of tomato bushy stunt and tobacco necrosis, the turbidity which develops on the cautious addition of ammonium sulphate to solutions of the virus at room temperature is reversed on cooling; but turnip yellow mosaic virus differs from the former viruses in that it crystallizes so readily from ammonium sulphate solutions that, after a few minutes at room temperature, crystallization has begun and the turbidity is then not removed by cooling.

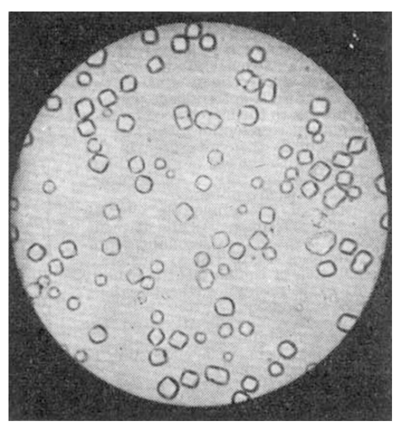


Fig. 2. CRYSTALS OF TURNIP YELLOW MOSAIC VIRUS (1/12TH OIL IMMERSION LENS).

Solutions of the virus give biuret and Molisch reactions, and the ultra-violet light absorption shows the maximum at about 260 mμ which is given by nucleic acid and nucleoproteins.

The phosphorus and carbohydrate content are those of a nucleoprotein containing about 16 per cent of nucleic acid of the ribose type.

ROY MARKHAM.
KENNETH M. SMITH.

Plant Virus Research Station,
Molteno Institute,
Cambridge.
Dec. 18.