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THE ANTIGENICITY OF DOLICHOS ENATION MOSAIC VIRUS

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A VECTORLESS, sap transmissible virus disease of *Dolichos lablab* L. was reported from Poona.[1] Subsequently this disease was noticed in Mysore and Madras States. The disease shows marked reduction of leaf blade caused by the suppression of growth in the interveinal areas, with the characteristic enations appearing on the lower side of leaves. These authors discussed the affinities of Dolichos enation mosaic virus (DEMV) and suggested that it resembled tobacco mosaic virus (TMV) in physical properties, Bean mosaic viruses 4 and 4 A in thermal inactivation and Pea streak virus in dilution end-point. By cross-protection tests in White Burley tobacco evidence was obtained that DEMV was not related to TMV[2] and was confirmed here by preliminary serological tests with TMV antiserum.

An attempt to test DEMV for its antigenic properties was, therefore, made and is reported here.

Seeds of *Dolichos lablab* (variety DL 231) which were kindly supplied by The Millet and Pulses Specialist, Agricultural College, Coimbatore, were raised in ordinary garden soil in 4" earthen pots, with 1-2 seeds. The plants were kept in a well illuminated greenhouse, with temperature around 30° C. Plants were kept in insect-free conditions through rigid nicotine spraying twice a week. The primary leaves of plants were inoculated with standard extract (a known fresh weight of infected leaves mixed with an equal volume of water, *i.e.*, 1 g. of leaf + 1 ml. of distilled water), using an abrasive 'Celite'. The leaves were sap-inoculated in the usual manner.

Precipitin reaction was carried out in short thick-walled tubes, half-immersed in a water-bath held at 37° C. for over a period of 1 hour. All serological reactions were carried out with 0·85% saline for dilutions.

Fresh leaves of systemically infected *Dolichos lablab* plants 15-20 days after inoculation, with leaves showing prominent mosaic symptoms, were collected and standard extract prepared. About 6-8 ml. of infective sap, in a thin-walled test-tube was heated for 10 min. in a water-bath maintained at 60° C. and the sap cooled immediately in cold water, thus ridding sap of plant proteins which was centrifuged for 15-20 min. at 3,000-3,500 r.p.m. The clear brown supernatant was dialysed against running tap-water for over an hour, the sap again centrifuged for 15 min. The pH of this clarified infective sap was around 5·7 and was used for immunizing rabbits. An aliquot of the same was inoculated against *Nicotiana glutinosa* and *Dolichos lablab* to test for possible TMV contamination.

A course of six intravenous injections of 1-3 ml. of the clarified infective sap at intervals of 3 days were given to an 'Albino rabbit'. The animal was bled ten days after the last injection and the blood centrifuged for 30 min. at 3,500 r.p.m. to give a clear antiserum.

The antiserum was tested against both healthy and diseased *D. lablab* sap to ascertain specificity of antiserum to DEMV. While a negative result was obtained with healthy plant sap, there was a clear specific positive precipitate in reaction to infected sap. The amount of antibodies present in antiserum to DEMV was then estimated. A two series dilution of antiserum, with a factor of five, was prepared using saline, one of the series forming saline control mixture. At a known dilution of standard extract of antigen (DEMV) at 1/5 and recording the time of precipitation in precipitin reaction, over a period of 30 min. it was possible to obtain a high titre value of 1/625, as shown in Table I. Antiserum of DEMV gives a dense granular precipitate suggesting that DEMV is likely to be a spherical particle.[3,4] A negative result was obtained when antiserum of DEMV was tested with TMV, suggesting that the two viruses are serologically not related. Antiserum

TABLE I

Showing titre value of antiserum to DEMV

	Antiserum to DEMV									
	1/1	1/5	1/25	1/125	1/625	1/1	1/5	1/25	1/125	1/625
Dilution of DEMV 1/5	++	++	−	−	−	−	−	−	−	−
	+++	+++	++	+	+?					
	++	+	+	−	−	−	−	−	−	
	++++	+++	++	++	++					
	+++	++	++	+	+*	−	−	−	−	

\+ : relative amount of antigen. * after 1 hour incubation.

to DEMV was mixed with an equal volume of glycerol (*i.e.*, 50%) and stored in narrow mouthed glass-stoppered dustproof bottles at -4° C. for future use.

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2. —, *Proc. 41st Ind. Sci. Congr.*, 1954, 90.
3. Bawden, F. C., *Plant Viruses and Virus Diseases*, Chronica Botanica, 3rd Ed., 1953.
4. Matthews, R. E. F., *Plant Virus Serology*, Cambridge University Press, 1957.

PHYSICS OF THE SOLID STATE

THE International Summer School on Physics of the Solid State was held at the Cavendish Laboratory of the University of Cambridge from 15th July to 13th August, 1959, under the Directorship of Professor N. F. Mott, F.R.S. Over 80 members were selected to attend the School of whom about 60 came from different countries. The School was financed by the funds of the Ford Foundation which also provided the travelling grants to many members of the School.

The subjects, covered by the course, could be divided under the following general headings: introductory lectures, theory of dislocations and point defects, chemical methods of observing dislocations, observation of dislocations by electron microscopy, applications of dislocation theory, contrast effects on electron micrographs of crystalline materials, electron and X-ray microscope techniques, colour centres in ionic crystals and mechanical properties of ionic crystals, defects in crystalline polymers, growth of crystals from the melt, and numerical calculations on dislocations and point defects. Seven visiting scientists and thirteen members of the University of Cambridge, delivered the courses of lectures.

Arrangements were made to set up, under the direction of group supervisors, study sections consisting of about twelve members to clear up difficulties arising with the academic side of the course. On three or four days a week, the afternoon sessions were mainly devoted to demonstrations, visits to laboratories and discussion of group meetings.

The introductory lectures on dislocations were given by Professor N. F. Mott. Dr. J. W. Mitchell (Bristol) gave the details for observing the dislocations by chemical methods. A series of lectures on the theory of defects and dislocations in Solids, was delivered by Dr. J. Fridel (Paris). Dr. M. J. Whelan (Cambridge) explained the principles of electron diffraction by crystalline materials and their applications in the interpretation of contrast effects on electron micrographs of crystals.

After outlining the techniques of electron and X-ray microscopy, recent advances in the design and construction of electron microscopes which have enabled details below 10 AU to be resolved, were explained. The use of replica techniques in the study of metal specimens with the electron microscope was illustrated with a description on the methods of preparation of replicas. Dr. P. B. Hirsch (Cambridge) dealt with the low temperature plastic properties of face centred cubic crystals and the observation of dislocation in thin films. Dr. A. Kelly (Cambridge) described the types of precipitation found in Aluminium and Copper with an account of X-ray and magnetic methods used to study the process of deformation in the interior of crystals. Current theories of the interaction of dislocations, with coherent precipitates were advanced. Dr. P. L. Pratt (Birmingham) spoke about the mechanical properties of ionic crystals.

Professor A. H. Cottrell (Cambridge) delivered a series of lectures on theory of fracture. The effects of "quenching" the metals, the techniques for growing crystals with high purity and perfection, the mechanical properties of such crystals, dislocations in semiconductors and twinning in crystals, formed the subject-matters of the other lectures. Dr. A. Seeger (Stuttgart) presented the methods that have been developed for quantitative calculations of the properties of dislocations and other defects. He also reported the results of such calculations on some physical problems.

It is not possible to include all the details of the lectures given during the course of the Summer School. But it is hoped that the above summary indicates the common grounds of interest found by the members working in such diverse fields as metallurgy and nuclear physics, in the course on Physics of the Solid State.

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