together in the medium. Tyrosine appreciably relieved the pronounced reduction in growth and phenolic production caused by phenylalanine but its own promoting effect when used alone was found much less in combination with phenylalanine.

Thus, *Crotalaria* cells failed to grow satisfactorily when phenylalanine or tyrosine or both were incorporated into the medium containing nitrate. Among the hypotheses which were considered to account for the amino acid effects was the idea that they inhibit growth by inhibiting the biosynthesis of other amino acids. The pathway of nitrate assimilation would seem a likely place, as also suggested by Filner[8], for one amino acid to prevent the synthesis of others. Phenylalanine seems to be more inhibitory than tyrosine as more reduction in growth resulted with phenylalanine medium.

Both the amino acids, phenylalanine and tyrosine, are direct precursors of phenolic synthesis.. In the light of this, increased production of phenolic materials per cell is obvious when they are incorporated into the medium. However, addition of tyrosine has enhanced the production of phenolic compounds substantially. Tyrosine is nearly four times less inhibitory to growth than phenylalanine. The effect of these amino acids on the growth may be due to their inihibition of nitrate assimilation pathway, particularly the glutamate generating system[8]. The synthesis of phenylalanine and tyrosine is dependent on the transamination reactions involving glutamate. This means, the endogenous synthesis of phenylalanine may be nearly four times less than tyrosine as evident from their effect on growth. The overall result is that tyrosine supported maximum whereas phenylalanine enhanced very little phenolic production. However, detailed investigation is demanded before concluding with confidence as the control mechanism of the pathway includes many complex enzyme systems[2].

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MECHANICAL TRANSMISSION OF WHITE FLY-BORNE YELLOW MOSAIC VIRUS OF *LABLAB NIGER* MEDIKUS (*DOLICHOS LABLAB* L.)

THE yellow mosaic disease is known to infect many leguminous crop plants and its successful transmission only by the white fly *Bemisia tabaci* Genn has been reported[1,4,5], while attempts to transmit the disease by mechanical inoculation were unsuccessful. However, recently a similar white fly-borne golden mosaic disease of bean was transmitted successfully by sap-inoculation[6]. The present study was therefore taken up to find out the possibility of transmitting a yellow mosaic disease of *Lablab niger* Medikus and the results are reported in this communication.

Lablab cultivar Co. 8 plants that were inoculated by the viruliferous *Bemisia tabaci* were used as virus sources in the present study. An enamel tray was filled to three-fourth of its capacity with tap water. A pair of pestle and mortar was kept in the tray which was then placed in a freezer till the water was frozen. Phosphate buffer 0·1 M at pH 6·6, 6·8, 7·0, 7·2, 7·4, 7·6, 7·8 and 8·0 was prepared and cooled in the freezer. Young leaves showing clear symptoms of yellow mosaic disease were macerated in the mortar kept in the ice tray with the phosphate buffer added at the rate of 3 ml/g of leaf material. The extracted sap was rubbed with the pestle on the cotyledonary leaves of 5 days old test plants that had been dusted with 600-mesh silicon carbide gently by having a thin cardboard pad below the leaves. Plants rubbed with the buffer alone served as control. The excess inoculum was washed away with tap water using a wash bottle. The plants after inoculation were kept in the glasshouse (temperature variation 21°–35°). The results are given in Table I.

The present white fly-borne yellow mosaic disease could successfully be transmitted by sap inoculation as per the method followed in the present study. The virus appears to remain infective in the extra cellular environment provided during this study. It may be seen from Table I that the

TABLE I

Effect of phosphate buffer at different pH on the mechanical transmission of yellow mosaic disease of lablab

Sl. No.	pH	Number of plants infected*	Percentage of transmission	Incubation period in days
1	6·6	17	68·0	9–15
2	6·8	13	52·0	9–15
3	7·0	19	76·0	7–14
4	7·2	18	72·0	7–11
5	7·4	23	92·0	7–10
6	7·6	25	100·0	7–10
7	7·8	23	92·0	7–10
8	8·0	25	100·0	7–11

* Number of plants inoculated; 25.

percentage of transmission ranged from 52·0 to 76·0 and 92·0 to 100·0 in the pH range of 6·6 to 7·2 and 7·4 to 8·0 respectively. The infection by the virus generally seems to be favoured by alkalinity of the buffer used for extraction. In all mechanical transmission tests, uninoculated control plants developed no symptoms of the disease.

Mechanical transmission of white fly-transmitted viruses causing yellow mosaic diseases has been reported in other countries—*Euphorbia* mosaic virus on seedlings of *Euphorbia prunifolia* and *Datura stramonium*[2], yellow mosaic on *Leonurus sibiricus*[3] and golden mosaic disease agent and *Euphorbia* mosaic disease agent[6]. This is believed to be the first report of the mechanical transmission of a white fly-transmitted virus causing yellow mosaic of lablab in India. The studies on the properties of the yellow mosaic virus of lablab are in progress.

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SHOOT FORMATION IN *CATHARANTHUS ROSEUS* (L.) G. DON CALLUS CULTURES

INTEREST in the group of plants known as Periwinkles has increased in the past few years, because of the isolation of vincaleucoblanthanine from *C. roseus*. This alkaloid has been tested clinically and is currently used in the treatment of Hodgkin's disease and chloriocarcinoma[1]. More than 66 alkaloids have been reported in *C. roseus*. Amongst these alkaloids, ajmalicine, a principal alkaloid of stem, and vinodoline, have been identified in stem and leaf callus cultures[2].

Physical, morphological, genetic and biochemical factors affect the growth and metabolism of plant tissue culture. This results in biosynthetic potentialities of the tissues[3]. During the tissue culture studies on medicinal plants of arid and semi-arid areas, *C. roseus* has been cultured. In this communication we report the shoot formation in *Catharanthus* callus cultures.

Callus tissues were raised from stem explants and the culture conditions were similar to *Crotalaria* cultures[4]. Tissues were grown and maintained on Murashige and Skoog's (MS) medium[5]. Various concentrations of kinetin, α-naphthalene acetic acid (NAA) and malt extract (ME) were incorporated in the medium before autoclaving.

Callus development from stem and pods (Fig. 1) were observed on MS medium. Callus tissues grew well on MS medium supplemented with NAA (0·25 to 5·0 ppm) and kinetin (0·25 to 1·0 ppm). The maximal wet weight (4·0 g) was obtained at 4 weeks growth on medium supplemented with NAA (1·0 ppm) and kinetin (0·5 ppm). The dark grown tissues were soft, fragile and yellowish-brown and tissues turned yellowish-green to brown in light. At higher kinetin concentrations (1·0 to 2·5 ppm) tissues