SUMMARY
Main symptoms

The infected turnip plants showed characteristic symptoms which included mosaic, mottling and curling of leaves followed by severe stunting of plants. Inoculated plants produced only few flowers and distorted root. The disease incidence was 40-80 per cent. Severe infection was observed in January and February 1984.

Host range and symptomatology

The virus has a wide experimental host range, infecting 63 species belonging to 20 families. Most of the hosts were in the families Solanaceae, Cruciferae and Asteraceae. No monocot species was found to be infected. Most of the Nicotiana species or cultivars viz., Nicotiana tabacum cvs. Samsun, Xanthi, White Burley, Bhopali Pakra, CTRI-Special, DR-1, Anand-3, Harrison's Special and N. megalosiphon showed local infection in the form of necrotic local lesions.

Chenopodium amaranticolor, C. album, C. murale, C. quinoa, Phaseolus lunatus and Gomphrena globosa were found to be good local lesion hosts but C. amaranticolor was most suitable for assay of virus.
Transmission

Four species of aphids, *Myzus persicae*, *Brevicoryne brassicae*, *Aphis gossypii* and *A. fabae* were tried for aphid transmission but none of them could transmit the virus. The virus was also not transmissible through dodder (*Cuscuta reflexa*), seeds (*B. rapa, N. glutinosa, N. sylvestris, Datura metel, D. stramonium, Trichosanthes anguina*) and soil. The virus was easily transmissible by sap.

Out of *N. glutinosa, N. megalosiphon, N. sylvestris* and *Cucumis sativus* evaluated for their suitability as propagation host for maintaining virus culture, the first one (*N. glutinosa*) was found most suitable as highest infectivity was found in sap obtained from this species after 13 day's of manual inoculation. Leaves were the best source of the virus.

Extraction medium

Various types of buffers (acetate, borate, citrate and phosphate) at different molarities and pH were tried. Out of these 0.1M phosphate buffer pH 7.5 was found most suitable for maintenance of virus infectivity. Addition of sodium sulphite 0.1% and EDTA 0.01M to the phosphate buffer enhanced infective virus content in crude sap.
Biophysical properties

Virus in crude sap of infected N. glutinosa lost its infectivity after heating at 65°C for 10 min; at a dilution of $10^{-5}$; it remained active till 72 h when stored at room temperature ($20\pm5^\circ C$) and 144 h at 4°C.

Purification

N. glutinosa was used for maintaining the virus culture. For clarification of the crude sap from infected N. glutinosa, organic solvents viz., butanol, carbon tetrachloride, chloroform were tested either alone or in different combinations. Sap was successfully clarified with 20% butanol and chloroform (1:1) without any adverse effect on virus infectivity, whereas others had an adverse effect on the infectivity of the virus.

Out of two procedures viz., (I) PEG-precipitation and (II) differential centrifugation used, the latter one proved most suitable and was used routinely. It involved extraction of sap from infected N. glutinosa leaves with 0.1M phosphate buffer pH 7.5 containing 0.1% sodium sulphite and 0.01M EDTA; clarification with a mixture of 20% chilled butanol and chloroform (1:1), centrifugation at 6,000 rpm for 10 min and stirring of the phosphate buffer phase with 1% Triton X-100 for 30 min followed by two cycles of differential centrifugation with resuspension of virus pellet in 0.1M phosphate buffer pH 7.5.
Further purification was achieved by rate zonal density gradient centrifugation. Purified preparation exhibited one light scattering band in sucrose and CsCl density gradient centrifugation.

Purified preparation gave a typical nucleoprotein spectrum in UV-spectrophotometer (A max 258 nm, A min 242 nm), one peak was found in analytical ultracentrifugation. The sedimentation coefficient for the virus was calculated as 118S. The purified preparation possessed a buoyant density as 1.32 g/cm³.

**Particle structure**

The purified preparation of virus negatively stained with 2% uranyl acetate showed flexuous rods measuring ca. 580 x 13 nm.

**Virus nucleic acid**

Nucleic acid constituted 5-6% of the total particle weight. The ratio 260/280 for nucleoprotein was 1.25.

**Protein**

Protein sub-units showed helical arrangement and a molecular weight calculated with the help of SDS-electrophoresis as 25,000±500 daltons.
Inclusion bodies

Three types of cytoplasmic inclusion bodies viz., laminar, banded and bundle type were observed in mesophyll cells of infected *N. glutinosa* tissues fixed in 3% glutaraldehyde and seen under electron microscope.

Serology

The virus was immunogenic; antiserum against the virus was prepared by injecting an albino-rabbit with the virus emulsified with Freund's incomplete adjuvant. One intravenous and two intramuscular injections were given, over a period of 3 weeks, the antiserum and antigen (virus) in tube precipitin tests had the titre 1:512 and 1:256, respectively. Good reactions in gel double diffusion test were observed when gel media consisted 1% agarose, 1% SDS in 0.1M phosphate buffer pH 7.5 containing 0.85% NaCl.

In ISEM (dip serology) the virus particles were found trapped and decorated when incubated with the PVX antiserum on the electron microscope grid, at a particular temperature for specific period.

Relationship

In gel double diffusion tests, the virus (antigen) showed strong reaction with PVX antiserum but no reaction with antisera to potato virus Y, potato virus S, potato aucuba mosaic
virus, cymbidium mosaic virus, white clover mosaic virus, narcissus mosaic virus and papaya mosaic virus.

Thus it is concluded that the present virus is a hitherto unknown strain of PVX infecting turnip and is tentatively called PVX Aligarh strain.