DISCUSSION
Launaea (Launaea aspleniiifolia Hook f.) is a weed widely found in Northern India. During a survey of virus diseases of weeds, a mosaic disease of launaea was found to be prevalent in and around Aligarh district. Investigations were carried out to establish the identity of the causal agent of the disease.

The disease was transmitted with ease by mechanical sap inoculation, by two species of aphids viz. *aphis craccivora* and *Myzus persicae* in non-persistent manner and by grafting but dodder (*Cuscuta reflexa*), soil and seeds failed to transmit the disease. Experimental host range studies revealed that the virus under study has a moderate host range. Out of sixty four plant species belonging to fourteen families, twenty six plant species belonging to nine families viz. Malvaceae, Achyranthaceae, Amaranthaceae, Apiaceae, Brassicaceae, Asteraceae, Solanaceae, Chenopodiaceae and Fabaceae were found susceptible to the virus. Most of the hosts were in the families Solanaceae and Chenopodiaceae. *Datura metel* was used as a propagation host. *Chenopodium amaranticolor* and *C. murale* were found to be good local lesion hosts for the virus but the former being most suitable was used for the quantitative assay.
Launaea mosaic virus in crude sap of propagation host retained its infectivity at 50°C for 10 min. and at a dilution of $10^{-4}$, but the virus lost its infectivity at a dilution of $10^{-5}$ and after heating for 10 min. at 55°C. In crude sap of propagation host virus retained infectivity up to 84 h at room temperature and for about 156 h. at 4°C. The virus attained highest concentration 12 days after mechanical inoculation in the leaves of *D. metel*.

Phosphate buffer (0.2M, pH 6.8) containing sodium sulphite (0.1%) and EDTA (0.1%) was found to be the most suitable extraction medium. Clarification of the crude sap was achieved by emulsification with 30% chilled chloroform. Purification of launaea mosaic virus involved precipitation of the virus from clarified extract with 6% PEG and 0.125% NaCl. Suspension of the precipitate in 0.2M phosphate buffer pH 6.8 was followed by one cycle of differential centrifugation. Further purification was achieved by rate zonal density gradient centrifugation in sucrose columns. After centrifugation for 2 h, the tube when examined in a dark room by projecting a narrow beam of light down the tube from the top showed a light scattering band. Infectivity was found associated with this band.

The purified preparation gave an UV-spectrum characteristic of nucleoproteins with $A_{260}/A_{280}$ ratio of 1:164 indicating approximately 5.52% nucleic acid (RNA) in the virus particle.
SDS-PAGE of viral capsid showed only one type of protein sub-unit with a molecular weight of c. 33,500 daltons.

Electron microscope studies of purified virus preparation revealed the presence of flexuous rods c. 730 nm long and 12 nm wide.

Ultrathin sections of infected *D. metel* leaves showed cytoplasmic cylindrical inclusions comprising pinwheels, scrolls and lamellar aggregates.

Antiserum against the LaMV raised in rabbit showed a titre of 1:2048 in tube precipitin tests. Immunosorbent electron microscopy and immunodiffusion (heterologous) tests revealed that the virus is closely related with *Datura leaf distortion virus* (DLDV), *Peru tomato virus* (PTV) and *Papaya ring spot virus* (PRSV).

The screening of the literature revealed that not much work has been carried out on the viruses infecting *launaea*. A virus causing mosaic disease on *launaea* was purified and characterised by Naqvi and Mahmood (1976). The virus reported by them has spherical particles of 30-35 nm diameter. Another report of virus infection on *launaea* (Padma *et al.* 1973) was restricted on the transmission and host range only. The morphology of a virus infecting *launaea* was given by Verma and Singh (1975). They reported thread like particles measuring 750-930 nm x 16-18 nm
possibly a potyvirus. However, this meagre information is insufficient to make a valid comparison with LaMV.

The LaMV isolate showed close serological relationship with *Datura leaf distortion virus* (DLDV), *Peru tomato virus* (PTV) and *Papaya ringspot virus* (PRSV). Comparison with these viruses is imperative to establish the identity of the virus isolated from *launaea*.

PTV resembles LaMV in mode of transmission and some physical properties in crude sap but has a much longer longevity *in vitro*. PTV shows strong serological relationship with PVY and a remote relationship with TEV (Fribourg, 1979) whereas LaMV shows no serological reaction with PVY and TEV. PTV has some hosts in common with LaMV but is restricted to families Chenopodiaceae and Solanaceae only whereas LaMV infects plants in nine families. LaMV though showing serological relationship with PTV does not appear to be the same virus or strain due to significant difference in its longevity *in vitro*, absence of serological relationship with PVY and ability to infect *Amaranthus*, *Vigna* and *D. stramonium* which are non-hosts of PTV.

LaMV shows serological relationship with PRSV. PRSV is transmitted by sap and by *M. persicae* in a non-persistent manner but not by seeds (Purcifull *et al.*, 1984) like the present
virus isolate. PRSV differs from LaMV in biophysical properties. PRSV infects cucurbits while the present virus did not infect any member of the family cucurbitaeae. Molecular weight of protein subunit of PRSV ranges between \((3.6-3.65 \times 10^4)\) which also differs from that of LaMV. However, the comparison of these two was not established in the same lab conditions.

LaMV shows close serological relationship with DLDV and also shows several properties in common. Symptomology and biophysical properties of DLDV (TIP 50°C) are similar to that of LaMV. DLDV is transmitted by mechanical inoculation of sap and by \(M. \ persicae\) and \(A. \ craccivora\) in non-persistent manner (Prasanna et al., 1996) like the present virus isolate. The morphology and cytoplasmic inclusion of the DLDV are also similar to that of LaMV. The antiserum titre of both the viruses is also same i.e. 1:2048.

However, DLDV is restricted to family Solanaceae whereas LaMV has a wider host range infecting twenty six plant species in nine families. \(Lycopersicon lycopersicum\), a host of LaMV is not infected by DLDV. No reaction is evoked on \(C. \ amaranticolor\) by DLDV which is a local lesion host of LaMV. A comparison as to the size of the particles is not possible as Prasanna et al. (1996) have not reported the actual size of DLDV particle.
A virus causing mosaic disease on launaea (*L. aspleniifolia*) has been tentatively identified as a member of potato virus Y group (Brunt, 1991). However, its particle morphology, aphid transmissibility, serological relationship, RNA percentage, buoyant density and ability to induce cytoplasmic inclusions in hosts cells place the virus isolate that we reported as a potyvirus group as defined by Hollings and Brunt in 1981 and can be elevated to a new genus of the Potyviridae family. The close serological relationships between LaMV and DLDV tempts one to conclude that it is a strain of DLDV but differences in biological characteristics, $A_{260/280}$ ratio of 1.23 for DLDV suggestive of higher amount of nucleic acid than that of LaMV indicates that launaea mosaic virus is a tentatively distinct virus of poty virus group.

In RT-PCR, an amplification product of 335 bp (using potyvirus group specific primer pair) also confirmed the present virus isolate to be a member of potyvirus group.