

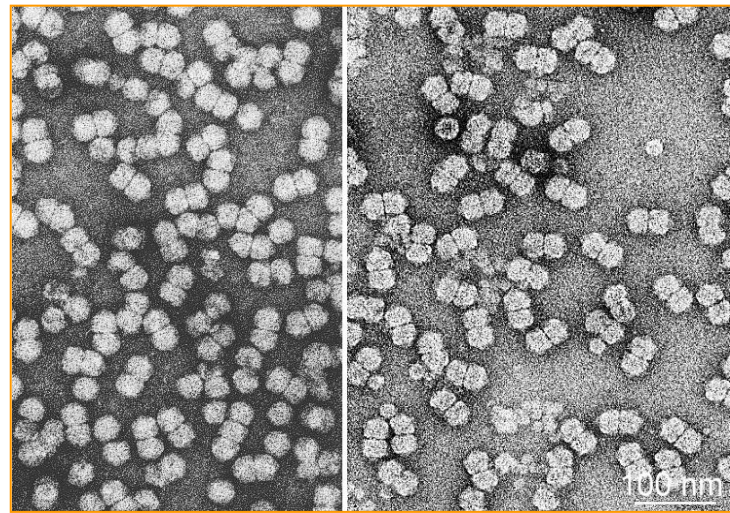
COTTON LEAF CURL DISEASE

Causal agent: Cotton leaf curl virus

1. Cotton leaf curl geminivirus (CLCuV) causes a major disease of cotton in Asia and Africa.
2. Severe epidemics of CLCuV have occurred in Pakistan in the past few years, with yield losses as high as 100% in fields where infection occurred early in the growing season.
3. Cotton leaf curl disease (CLCuD), a devastating disorder of cotton in Pakistan, is caused by a whitefly-transmitted begomovirus (*Cotton leaf curl virus*; CLCuV).
4. Leaves of infected cotton curl upward ----- Cotton leaf curl disease (CLCuD)
5. Infected plants bear leaf-like enations on the underside along with vein thickening.
6. Plants infected early in the season are stunted and yield is reduced drastically.

The virus:

1. Cotton leaf curl disease is caused by a complex of begomovirus species, all of which incite similar symptoms in cotton and are transmitted by the whitefly *Bemisia tabaci*.
2. All begomovirus species causing cotton leaf curl disease have geminate particles, approximately 18-20 nm in diameter and 30 nm long and a circular, single-stranded DNA genome.

**Cotton leaf curl virus
(CLCuV)****Virus classification**Group: Group II (ssDNA)Family: GeminiviridaeGenus: BegomovirusSpecies: ***Cotton leaf curl virus*****History of break-out of CLCuD in Pakistan**

1. 1967: Recorded in Multan
2. 1991-95 major damaging disease in Pakistan

Losses 80% yield losses.

3. 2001: During the growing season symptoms of CLCuD were observed on all resistant varieties at Burewala, District Vehari
4. 2002: disease symptoms were seen throughout the district.

Symptoms & damage:

1. Upward and downward curling of leaves accompanied by small as well as main vein thickenings on leaves, pronounced on underside.
2. If a diseased leaf is viewed from beneath against the light, thickened vein found darker green and opaque than the normal.
3. In extreme but not in frequent cases, formation of the cup shaped or leaf laminar (veins) out growth called "enation" appears on the back or underside of the leaf.
4. The newly produced leaves are small, excessively crinkled and curled at the edge.
5. The primary stem often tends to grow taller than normal.
6. The inter-nodes being elongated and irregularly curved but sometimes the whole plant is stunted.
7. The flowers checked in growth and become abortive.
8. Bolls remained small in size and failed to open.
9. All parts of badly hit plants are very brittle and ready broken.



Symptoms of cotton leaf curl disease at Burewala, Pakistan on resistant variety FH 900.

Thick dark veins and leaf-like outgrowths or enations can be seen on the main vein

Transmission

1. The disease transmitted by feeding of the white fly, *Bemisia tabaci* within 6.5 hours.
2. A single female, carrying virus can infest many plants.
3. White fly survive on as many as 53 host plant species, and is responsible for transmitting 23 crop diseases in region. At global level, white fly infests 600 different plant species.

Disease Cycle

The primary source is the viruliferous whitefly vector *Bemisia tabaci*. The alternate hosts and cultivated hosts serve as virus reservoirs throughout the year. Not transmitted by seed or contact.

Management strategies

1. Cultivation of disease resistant variety is only safe measure.
2. Seed treatment:
 - a. Imidaclopride 80% yield boost
 - b. Thiamethoxam 18% yield increase
3. Proper use of irrigation and chemical fertilizers improves the disease resistant power in cotton plants.
4. White fly transmits cotton leaf curl virus from diseased plant to healthy one, hence white fly must be controlled.
5. Lady's finger (okra), sun kukra, china rose, thorn apple, mint, karund, cucurbits (especially water melon), beans, tomatoes, tobacco, chilies, soy bean, sun flower, cow peas, egg plant, holly hock (gul-e-khera), zinnia, sesame, Ak (*Calotropis*), shesham, citrus species etc. are recorded as alternate host plants of cotton leaf curl virus as well as white fly. Therefore, they all must be eradicated before and during cotton cropping season.
6. Cotton growing zones may play a better role for this purpose.