

Transmission of Plant Viruses by Aphids, Whiteflies

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Aphids (Order: Hemiptera, Family: Aphididae) are among the most important insect vectors of plant viruses worldwide. They transmit more than 200 plant viruses, mainly belonging to the Potyvirus, Luteovirus, and Cucumovirus groups. Their piercing-sucking mouthparts make them highly efficient vectors.



General Characteristics of Aphids:

To identify aphids as vectors, observe the following common morphological and biological features:

- Soft-bodied, small insects (1–4 mm long)
- Pear-shaped body
- Cornicles (siphunculi) - Two tube-like projections on the abdomen • A key identifying feature of aphids
- Antennae long and segmented
- Wings - Winged (alate) and wingless (apterous) forms present • Alates appear during dispersal and virus spread
- Color - Green, yellow, black, brown, pink depending on species

Aphid species acting as vectors:

1. **Myzus persicae** (Green peach aphid) | Most important vector species | Transmits over 100 plant viruses | Hosts include potato, tobacco, tomato, chilli, pepper, brinjal
2. **Aphis gossypii** (Cotton aphid) | Vectors Potyviruses and Cucumoviruses | Hosts: cotton, cucurbits, papaya, okra
3. **Rhopalosiphum maidis** (Corn leaf aphid) | Vector of Maize dwarf mosaic virus | Found on maize and sorghum
4. **Rhopalosiphum padi** (Bird-cherry oat aphid) | Vector of Barley yellow dwarf virus (BYDV) | Found on cereals and grasses
5. **Toxoptera citricida** (Brown citrus aphid) | Vector of Citrus tristeza virus (CTV) | Most dangerous virus of citrus

Modes of Virus Transmission by Aphids:

Non-persistent (Stylet-borne) :

- Quick acquisition (seconds)
- Virus stays only in the mouthparts
- Example: Cucumber mosaic virus

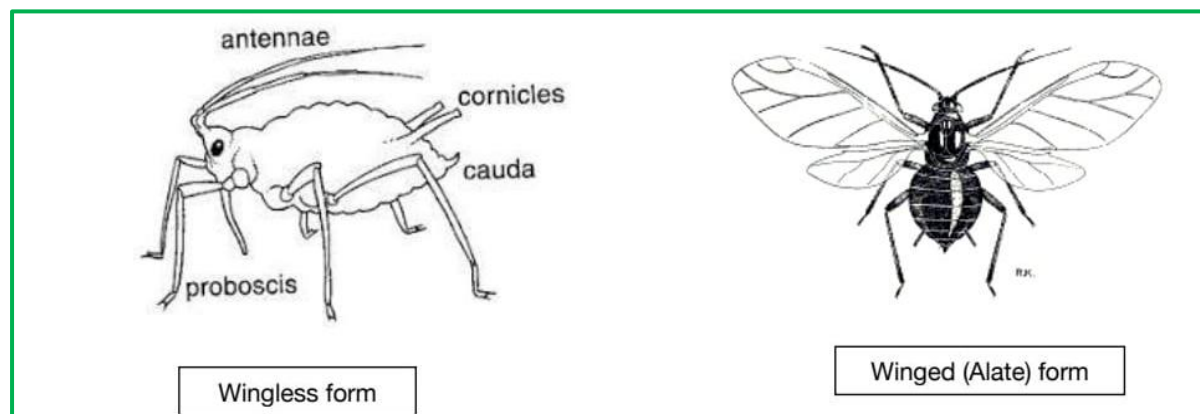
Semi-persistent :

- Virus retained for hours
- Example: Cauliflower mosaic virus

Persistent / Circulative

- Virus circulates in aphid body

- Retained for longer duration
- Example: Barley yellow dwarf virus



Identification of aphids in field

- Check underside of young leaves (aphids prefer tender growth)
- Look for honeydew and sooty mold
- Use yellow sticky traps (aphids are attracted to yellow)
- Winged (alate) aphids indicate active spread of disease

Whiteflies

Whiteflies (Order: Hemiptera, Family: Aleyrodidae) are significant vectors for numerous plant viruses, acting as highly efficient carriers via their piercing-sucking mouthparts, transmitting pathogens like Begomoviruses, Criniviruses, and Ipomoviruses in a semi-persistent or persistent manner, causing major crop losses in vegetables, cotton, and other crops. The most notorious vector is the *Bemisia tabaci* complex, which spreads devastating viruses such as Tomato Yellow Leaf Curl Virus (TYLCV)

Morphological features

Adult:

- Small insect, about 1–1.5 mm long.
- Body and wings covered with white waxy powder.
- Wings held roof-like over the body. Eyes reddish, body yellowish in colour.

Nymph (Fourth instar or “puparium”):

- Oval, flat, and translucent yellowish-green in colour.
- Found attached to the lower surface of leaves.
- Immobile during later stages.

Eggs:

- Tiny, pear-shaped, and laid on the undersides of leaves in circular patterns.
- Initially white, turning brown before hatching.

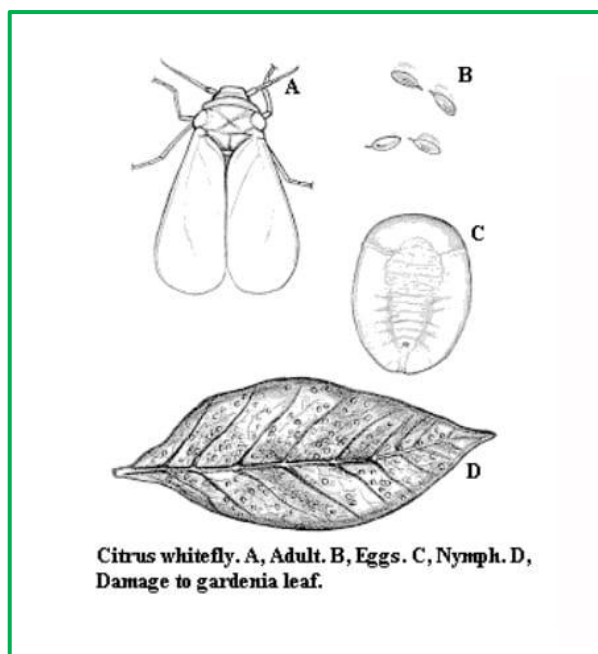
Mode of transmission:

Type: non-propagative transmission. Persistent–Circulative mode

- The whitefly acquires the virus while feeding on infected plants and retains it for life.
- It can transmit the virus to several healthy plants during feeding

Important plant viruses transmitted by whiteflies:

- Tomato: Tomato leaf curl Tomato leaf curl virus (ToLCV)
- Cotton: Cotton leaf curl Cotton leaf curl virus (CLCuV)



- Chilli: Chilli leaf curl Chilli leaf curl virus (ChiLCV)
- Cassava: Cassava mosaic disease Cassava mosaic virus
- Beans: Bean golden mosaic Bean golden mosaic virus

Identification of whiteflies in the field/lab:

- Collect infested leaves from the underside.
- Observe under a hand lens (10x) or stereomicroscope White, powdery adults resting on leaf undersides.
- Characteristic waxy wings and yellowish body.
- Oval, flat nymphs attached to leaf surface.
- Scale-like nymphs and eggs arranged in patterns



Conclusion

Aphids and whiteflies serve as the primary biological bridges for plant virus dissemination, transforming localized pest issues into widespread agricultural epidemics. By utilizing specialized piercing-sucking mouthparts, these insects bypass the plant's protective cell walls to deliver viral particles directly into the vascular system. This transmission occurs through diverse mechanisms, ranging from non-circulative "stylet-borne" transfers that happen in seconds to complex circulative processes where the virus must journey through the insect's own body before inoculation. Because these viruses are often incurable once established, the management of aphids and whiteflies remains the most critical line of defense in protecting global food security and preventing the devastating yield losses associated with viral outbreaks.

References

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