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Chilli Viral Disease complex: A serious threat for chilli cultivation

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Introduction

Chilli (*Capsicum annuum*) is not just a spice and vegetable but also an important cash crop supporting millions of farmers. Grown year-round in tropical and subtropical climates, cultivating the crop on scales ranging from large commercial farms to small kitchen gardens.

Chilli cultivation is a major source of income for rural farmers, contributing significantly to the livelihood of farming communities. Where chilli production faces a serious threat from viral diseases. Out of 65 known viruses, three are particularly destructive namely begomoviruses causing Chilli Leaf Curl Virus (ChiLCV), Cucumber Mosaic Virus (CMV), and Chilli Veinal Mottle Virus (ChiVMV). These viruses severely reduce yield and fruit quality, leading to fetch lower market prices and considerable economic losses. In severe cases, farmers may lose up to their entire crop, resulting in decreased farmers income, increased debt, and financial problems, especially for small and marginal farmers who depend heavily on chilli cultivation as their primary source of income for livelihood.

Major Viral Diseases of Chilli in India

1. *Begomoviruses* causing *Chilli Leaf Curl Virus* (ChiLCV) disease

Leaf curl disease of chilli is currently a serious problem in all the major chilli growing area of India. The characteristic field symptoms of leaf curl disease in chilli are upward curling, puckering and reduced size of leaves. Severely affected plants are stunted and produced no fruit. It is caused by a virus transmitted mainly by whiteflies known to be tiny insects that feed on leaves. When whiteflies feed on an infected plant they carry the virus to healthy plants, spreading it quickly. The severity of disease increases when it occurs in mixed infection with thrips or mites. In severe cases farmers may lose almost their entire harvest. As of now globally 14 begomovirus species are reported to be associated with *Chilli Leaf Curl Virus* (ChiLCV) disease. Among these, *Tomato leaf curl New Delhi virus* (ToLCNDV), *Chili leaf curl Palampur virus* (ChiLCPaV), ChiLCV, *Chili leaf curl Vellanad virus* (ChiLCVeV), *Chili leaf curl Salem virus* (ChiLCSV), *Chili leaf curl Gonda virus* (ChiLCGV), *Chili leaf curl Ahmedabad virus* (ChiLCAV), *Papaya leaf curl virus* (PaLCuV), *Chili leaf curl Bijnour virus* (ChiLCBV) has been reported from India.

2. Cucumber Mosaic Virus (CMV)

CMV is a widespread virus that can infect over 350 plant species, including vegetables, weeds, and ornamental plants. It spreads mainly through aphids, small green insects that transmit the virus within seconds and can also pass through infected seeds and nursery plants.Infected plants show mosaic-like leaves, stunted growth, and pale foliage, producing smaller and fewer fruits. If plants are infected early, yield losses can reach 70–80%.

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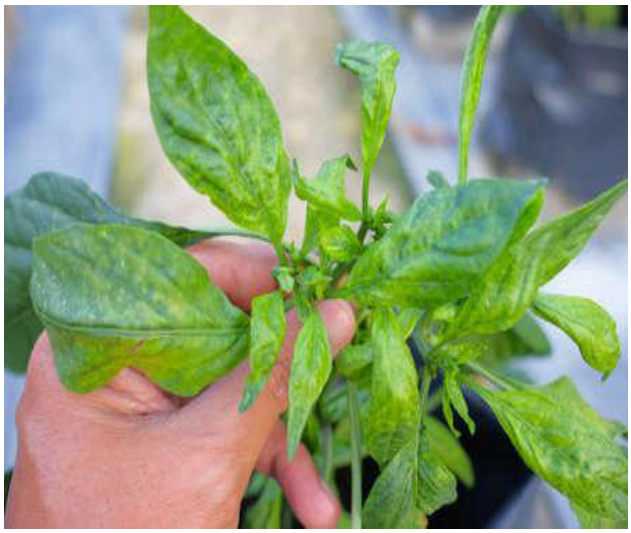
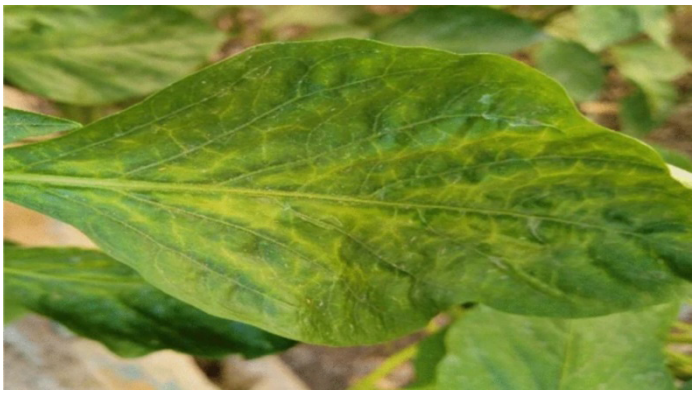
3. Chilli Veinal Mottle Virus (ChiVMV)

ChiVMV affects chillies in some parts of India. The virus causes dark green mottling, vein banding, leaf curling, and sometimes dead spots on leaves. Plants often produce few or no fruits, and those that grow are small. ChiVMV spreads through sap contact or by aphids and has been reported in Karnataka, Tamil Nadu, and other regions.



a. Chilli Leaf Curl Virus (ChiLCV) **b. Cucumber Mosaic Virus (CMV)**



c. Chilli Veinal Mottle Virus (ChiVMV)

Management of Chilli Viral Disease Complex

Chemical Control

Pesticides are still the most effective way to control the insects that spread viruses. For example, Apply Carbofuran 3G @ 4-5 Kg/acre to control sucking pest complex, Imidacloprid 150 mL/ha and Thiamethoxam 0.25 g/L water reduce aphid and whitefly populations. Regular spraying and seed/root treatment can significantly reduce disease incidence.

Botanical and Eco-Friendly Methods

Neem-based products like neem oil 3-5 mL/L and neem seed extracts 50g/L are safe alternatives to

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chemicals. They reduce insect populations and protect beneficial insects. Other plant extracts, such as from spinach, can also lower virus transmission rates.

Cultural Practices

Remove and destroy the previous year susceptible crops, particularly solanaceous weeds and volunteer plants. Use seeds from healthy plants of previous season. Growing nursery in protected structures. Removal of infected seedlings and weed hosts from nursery as soon as seen. Treatment of seedlings with proper systemic insecticide to control vectors. Use of yellow or blue sticky traps just above the plants to control insect vector. Transplanting dates should be adjusted to avoid peak season of the vector population. Use of reflective (silver colour) plastic mulch. Use of border crops or hedges which are more attractive to the vectors than pepper crop.

Integrated Pest Management (IPM)

Combining chemical, botanical, and cultural methods works best. Seed treatment, nursery protection, reflective mulches, and proper spacing all reduce virus spread. Farmers using these techniques have reported higher yields and healthier crops. (Cyantraniliprole 10.26% OD @ 1.8 ml/l + Neem oil @ 2 ml/l, Spinetoram 11.7% SC (w/w) @ 0.1% + Neem oil @ 2 ml/l + Thiamethoxam 25% w/w @ 1 ml/2 l water, Beauveria bassiana @ 5 g or 5 ml/l + Neem oil @ 2 ml/l, Spirotetramat 11.01% OD + Imidacloprid 11.01% SC @ 5 ml/l + Neem oil @ 2 ml/l, and Thiamethoxam 25% w/w @ 1 ml/2 l + Neem oil @ 2 ml/l + Diafenthiuron 50% WP @ 8 g/10 l water applied in rotation).

Economic Impact

Viral diseases can reduce chilli yields by up to 98%, causing severe economic losses. These outbreaks threaten farmers' incomes and regional economies, emphasizing the need for effective management strategies.

Conclusion

Chilli viral diseases, especially those caused by *Begomoviruses*, CMV, and ChiVMV, have become a major threat for farmers in India. These viruses spread quickly through insect vectors like whiteflies and aphids, causing severe yield and quality losses. Effective management requires a combined approach using chemical, botanical, and cultural methods under an Integrated Pest Management (IPM) program. By adopting timely control measures, maintaining field hygiene, and using eco-friendly practices, farmers can protect their chilli crops, improve productivity, and ensure a stable income.