
# 13. Annex: Regulated Pests

## *High plains wheat mosaic virus* (HPWMoV)

**July 2023**

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# 1. Technical description of the plague

## 1.1 Name of the disease

### 1.1.1 Agent etiological

**Preferred name:** *High Plains wheat mosaic virus* (HPWMoV)

**Synonymy:** *High Plains virus*
*Maize red stripe virus*
*Wheat Mosaic virus*

**Taxonomic categorization:**

Class: Ellioviricetes
Order: Bunyavirales
Family: Fimoviridae
Genus: Emaravirus
Species: *High plains wheat mosaic virus*

## 1.2 Hosts / Species affected

*Avena sativa*
*Bromus secalinus*
*Hordeum jubatum*
*Hordeum vulgare*
*Secale cereale*
*Setaria glauca*
*Setaria viridis*
*Triticum aestivum*
*Zea mays*

## 1.3 Cycle of the disease

### 1.3.1 Transmission and survival

*High plains wheat mosaic virus* (HPWMoV) is a relatively new pathogen, detected in 1993 in the high plains of the United States in wheat and corn crops. The virus was purified in 2006 by Skare *et al.* (2006). HPWMoV was identified as a definitive species of the genus Emaravirus in 2014 (Tatineni *et al*., 2014).

This new pathogen usually occurs together with *Wheat streak mosaic virus* (WSMV) since both viruses are transmitted by the same vector, *Aceria tosichella* Keifer (Acarina: Eriophidae), which affects wheat, corn, other cultivated grass species (oats, barley, rye) and weeds (Argüello and Truol, 2009). Another way of natural transmission of this virus is through infected seeds. In this regard, it has been demonstrated according to several studies that HPWMoV can be transmitted by seed with a percentage ranging from 0.008 to 4% (Lebas *et al*., 2005; Nischwitz, 2020; EFSA, 2022).

The vector *A. tosichella* is also called *Wheat curl mite* (WCM), since it causes a leaf curl in wheat and is protected inside the leaves (Argüello and Truol, 2009). *A. tosichella is* a pest of low mobility, capable of dispersal by wind and with the help of larger arthropods.

The host range of HPWMoV is limited to members of the Poaceae and includes several cereals. Barley, maize, oats, rye, and wheat were infected by HPWMoV in greenhouse trials. The grasses *Bromus secalinus* and *Setaria glauca* [*S. pumila*] were among the many infected (Seifers *et al*., 1998 cited in CABI, 2023). Plants infected by HPWMoV at the seedling stage are much more affected than those infected at later stages. Both wheat and maize infected at more mature stages may develop few, if any, symptoms. Mahmood *et al*. (1998 cited in CABI, 2023) demonstrated that there can be a relatively high incidence of HPWMoV infection in wheat plants that mature without symptoms. Susceptible maize infected at a seedling stage may be severely affected or even die, while similar HPWMoV infection at a more advanced growth stage may go unnoticed (Jensen, 1994 cited in CABI, 2023). HPWMoV can be detected in all parts of the plant by ELISA. Ahn *et al*. (1998 cited in CABI, 2023) found HPWMoV in all cell types of infected leaves of maize and wheat.

### 1.3.2 Incidence

HPWMoV mainly affects wheat and maize crops, with both the virus and the vector (*A. tosichella*) occurring in the United States, Canada and Argentina (Alemandri *et al*., 2011; CABI, 2023). In the United States, this virus is widely distributed in the West, where losses of up to 100% have been reported in sweet corn and, in the case of grain corn, yield reductions of up to 75%. In Argentina, HPWMoV has been detected mainly in wheat (Argüello and Truol, 2009), but also in spontaneously growing corn and in barley plants as an alternative host (Alemandri *et al*., 2011).

This virus can be transmitted through sweet corn seeds, although at a low incidence (CABI, 2023), with a 4% incidence recorded for seeds from Colorado (United States) by ELISA test (Blunt and Hill, 2004).

### 1.3.3 Symptoms associated with different organs and phenological stages

Symptoms of HPWMoV in wheat are mainly manifested in leaves. Leaf rolling, mottling, chlorosis and/or necrosis can be observed, and severe dwarfing can also occur. Symptom intensity can vary from medium to severe depending on the time of infection, temperature, susceptibility of the host and whether it is found with mixed infections with WSMV. In the latter case, symptoms become more important compared to single infections, manifesting severe mosaic and streaking, decrease in the number of spikelets and spikelets, and sudden death of plants in cases where the infection has occurred in early phenological stages (Argüello and Truol, 2009).

In maize, HPWMoV produces reddish streaking on leaf margins and tips, as well as chlorotic spots and streaks, necrosis of lower leaves and plant death (Argüello and Truol, 2009).

### 1.3.4 Behavior and distribution in the batches

Seifers *et al*. (1997) report a high incidence of this virus in sweet corn productions adjacent to wheat fields, however they also observed that the incidence decreased with increasing distance from the wheat crop. This is because HPWMoV transmission via *A. tosichella* is unlikely to *occur* over long distances.

### 1.3.5 Similarities with other pathogens

In Argentina it is possible to find mixed infections produced by WSMV and HPWMoV because *A. tosichella* can simultaneously transmit both viruses (Dumón *et al*., 2013). Although in field conditions it is very difficult to distinguish the symptoms caused by each of these viruses (Mahmood *et al*., 1998), in mixed infections the symptoms are more accentuated (Skare *et al*., 2006; Argüello and Truol, 2009).

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## 3. Annex: Figures

**Figure 1:** Maize plants with dwarfism, chlorosis, wilting and foliar necrosis caused by *High plains wheat mosaic virus* (HPWMoV) (ANPROS - SAG, 2022).

**Figure 2:** Dwarfism in corn plant caused by *High plains wheat mosaic virus* (ANPROS - SAG, 2022).

**Figure 3:** *High plains wheat mosaic virus* (HPWMoV) symptom in sweet corn (Forestry Images, 2018).

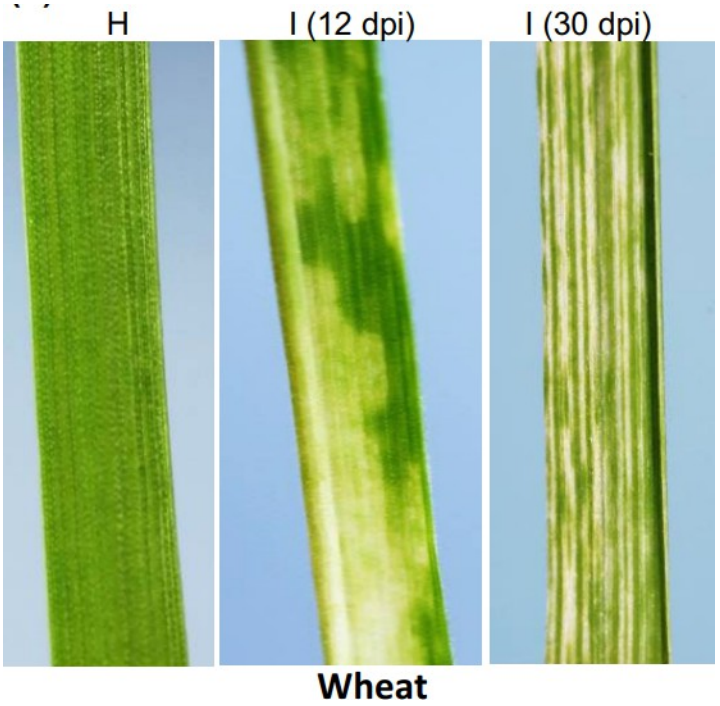


**Figure 4:** Symptoms of *High plains wheat mosaic virus* (HPWMoV) in wheat. H- Healthy leaf. I - Leaf with symptoms 12 and 30 days after infection (Tatineni and Hein, 2021).


**Figure 5:** *High plains wheat mosaic virus* (HPWMoV) symptoms in maize (Tatineni and Hein, 2021).