

Virus diseases of cereals in Sweden – an overview

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Three viral diseases of cereals have caused large crop losses in Sweden

- Wheat dwarf disease (vetedvärgsjuka)
- Oat sterile dwarf disease (dvärgskottsjuke)
- Barley yellow dwarf disease (rödsotsjuke på havre, gulsotsjuke på korn)

Additional diseases have been recorded

- Cereal tillering disease on barley and oats; Maize rough dwarf virus
- European wheat striate mosaic on oats, wheat and barley; European wheat striate mosaic virus
- Oat blue dwarf virus, Brome mosaic virus, Tobacco necrosis virus, Ryegrass mosaic virus

Wheat dwarf disease



Wheat dwarf virus transmitted by the leafhopper
Psammotettix alienus

Wheat dwarf disease

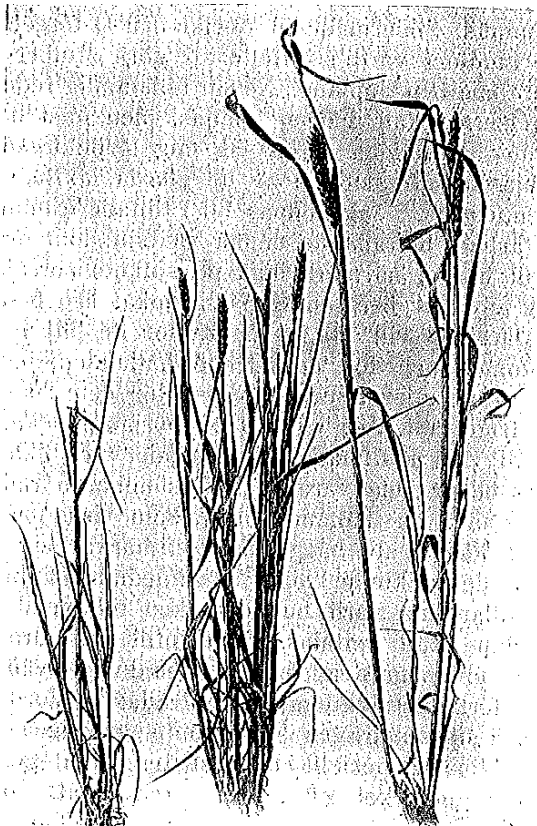
Outbreak in Sweden 2009: 80% crop loss in some fields



Affected fields with reduced tillage

Wheat dwarf disease

Outbreak in Sweden 1918: 5.1 million SEK of estimated loss in counties of Södermanland and Östergötland



E. Henning



A. Tullgren

Vad som mest frapperar en, då man reser kring och ser sjukdomen på olika platser, är, hur lokalt den kan uppträda. Så t. ex. är det ju ej alls ovanligt, att man ser tvenne fält bredvid varandra, det ena oskadat, det andra komplett förstört. Frågar man nu odlaren om orsaken därtill, får man nästan alldeles säkert det svaret, att det oskadade såddes sent, det skadade tidigt. Vidare gör han

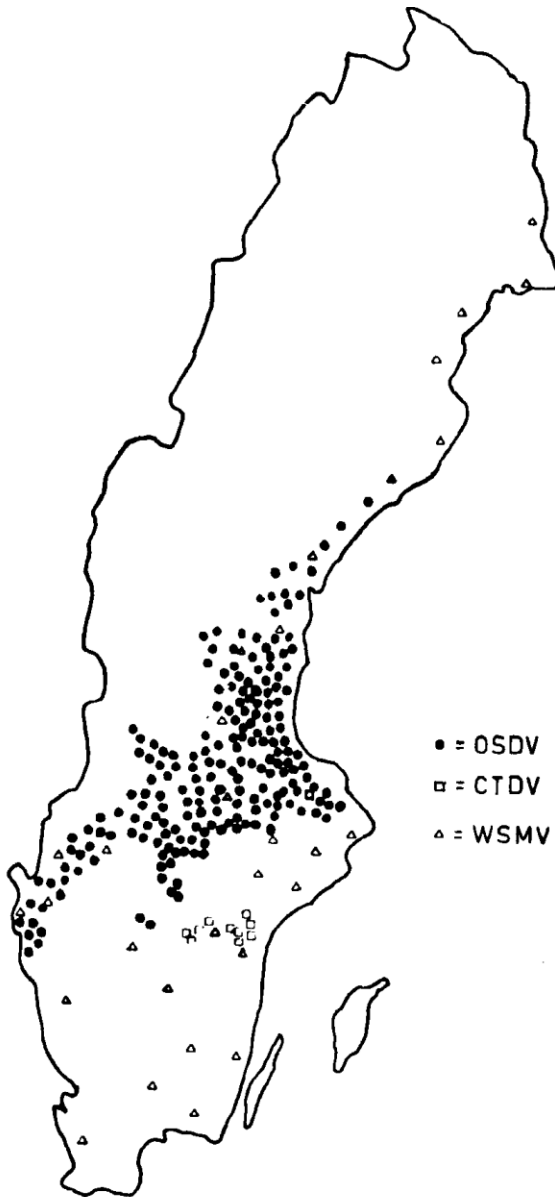
A. Tullgren, Landmannen (1918)

Oat sterile dwarf disease



Oat sterile dwarf virus transmitted by the planthopper
Javesella pellucida





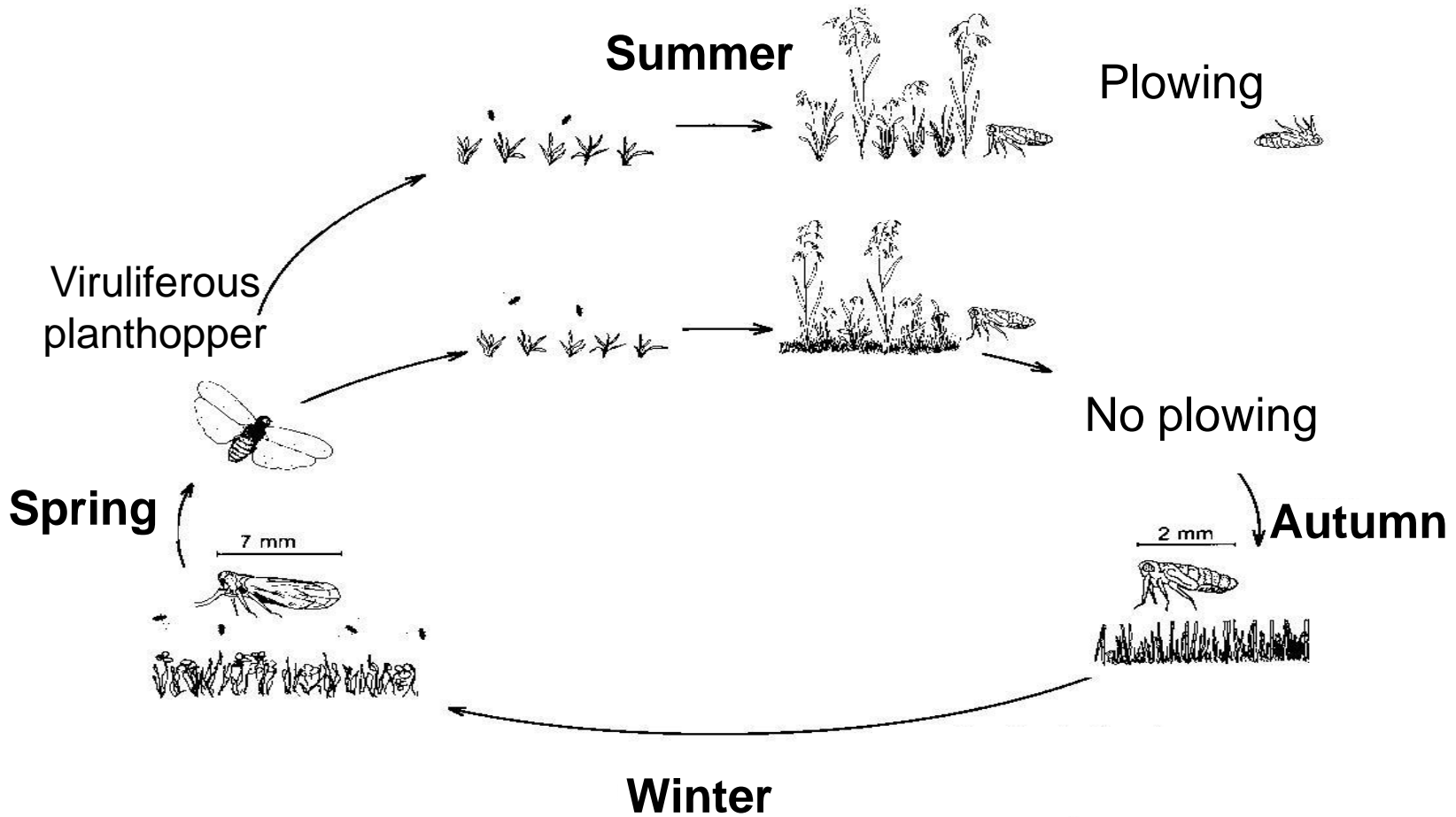
Oat sterile dwarf is widely distributed in central Sweden

Distribution of planthopper-borne viruses in Sweden 1960-1973

OSDV=Oat sterile dwarf virus
CTDV= Cereal tillering disease virus
WSMV=Wheat striate mosaic virus

Lindsten 1974 Microbiologija 11: 55-66

Disease cycle of oat sterile dwarf (In oats and forage grass)



Barley yellow dwarf



Spring infection of oats



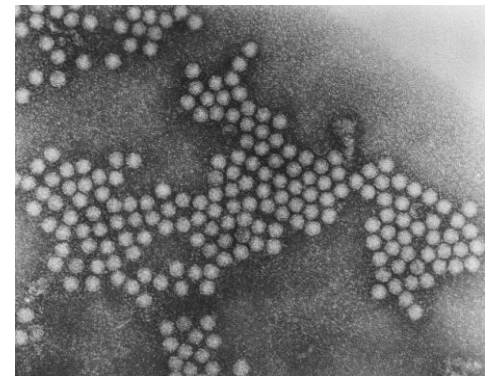
Autumn infection of barley; Photo Roland Sigvald

Infection of cereals and grasses by barley yellow dwarf-associated viruses are common

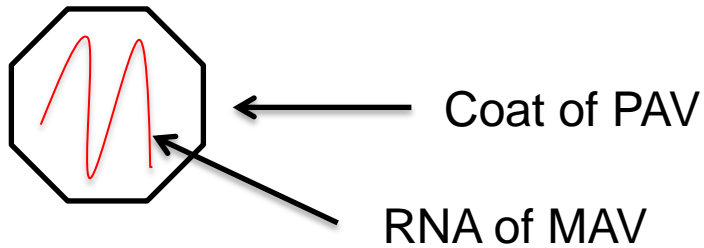
Three variants of barley yellow dwarf-associated viruses identified by ELISA in Sweden

- Barley yellow dwarf virus-PAV transmitted by *R. padi*/*S. avenae*
- Barley yellow dwarf virus-MAV transmitted by *S. avenae*
- Cereal yellow dwarf virus-RPV transmitted by *R. padi*

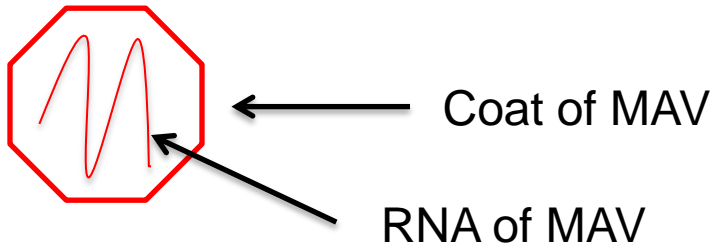
Often detected in mixed infections



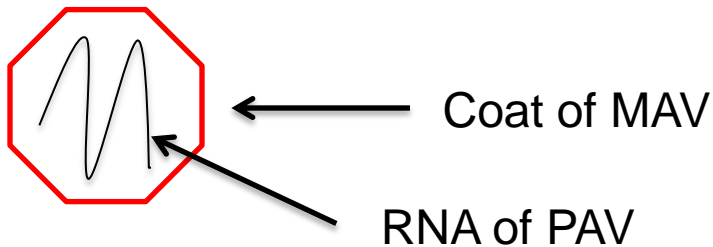
Transcapsidation



Transmission by *R. padi* or *S. avenae*



Transmission by *S. avenae*



Transmission by *S. avenae*



ELISA detects closely related viruses of different species

Serotype (ELISA)

BYDV-PAV

BYDV-MAV

CYDV-RPV

Species (Sequence analyses)

BYDV-PAV, BYDV-PAS, BYDV-OYV

BYDV-MAV, BYDV-GAV

CYDV-RPV, CYDV-RPS, BYDV-GPV,
BYDV-RMV

High diversity of BYD-associated viruses in Sweden

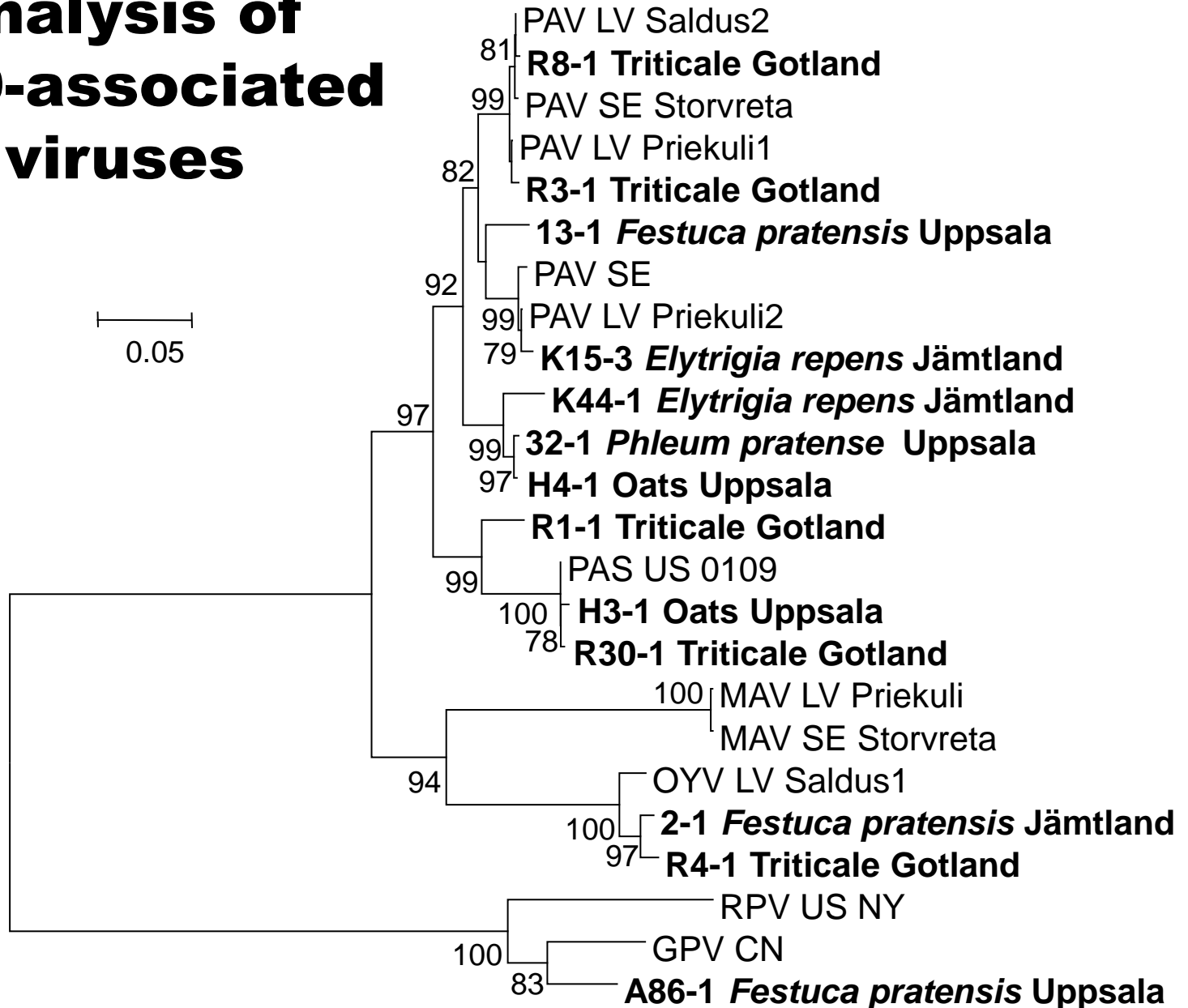


Triticale on Gotland:
BYDV-PAV, BYDV-PAS, BYDV-OYV



Cereals and grasses at Ultuna:
BYDV-PAV, BYDV-PAS, BYDV-OYV,
BYDV-MAV, BYDV-GPV, BYDV-RMV

Phylogenetic analysis of BYD-associated viruses



Important factors for virus spread and its effects

- Presence of virus sources; Plowing, fallows
 - Presence and activity of vectors
 - Timepoint for infection; Sowing time
 - Treatment: Insecticides
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- With a milder climate, the problems with autumn and spring infections with viruses will probably increase

Virus infections in grasses are common but often symptomless



Wheat dwarf virus, Oat sterile dwarf virus and Barley yellow dwarf virus persist in grasses, which may act as sources for transmission to cereals

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