

Survey on *Plum pox virus* in Norway

Blystad, D.-R.¹, Knudsen, R.², Spetz, C.¹, Haugslie, S.¹, Ørstad, K.¹, Cambra, M.³, Munthe, T.¹

¹ Norwegian Institute for Agricultural and Environmental Research, Plant Health and Plant Protection Division

² Norwegian Food Safety Authority

³ IVIA, Spain

Abstract

In 1998 *Plum pox virus* (PPV) was detected for the first time in Norway. Virus-like symptoms were observed on several trees in a collection of plum cultivars at Njøs Research Station in the Sogn og Fjordane County in West Norway. The Norwegian Food Safety Authority and the Norwegian Crop Research Institute immediately started surveying other variety collections around the country, nuclear stock material and orchards in all important plum-growing areas. Since 1998 we have surveyed the main part of the commercial plum orchards in Norway. About 75 000 individual trees have been tested. About 1 % of the trees have been found infected by PPV. Only the PPV-D strain has been found. It is suspected that the main infection source was infected plums or apricots imported to Njøs around 1970 or earlier. In most plum orchards in Norway, the spread of PPV by aphids is relatively slow. Therefore, we expect to be able to eradicate PPV from commercial plum orchards in the near future. The eradication work is continuing.

Keywords: *Plum pox virus*, survey

Introduction

We did not think Plum pox virus (PPV) could be a problem in Norway until we detected PPV in a collection of plums at Njøs, Sogn og Fjordane County, in 1998. Almost all virus-like symptoms seen in this collection could be related to PPV and ca 22 % of the trees were infected by PPV. We also found *Apple mosaic virus*, *Prunus necrotic ringspot virus*, *Prune dwarf virus* and *Apple chlorotic ringspot virus*, but none of these viruses seemed to be as related to the symptoms as PPV (Blystad et al. 2007). The pattern of distribution of infected trees, including the spread to an orchard of plum seedlings hinted to an insect transmission of PPV. By registration of the spread of virus into a nearby orchard of plum seedlings we also got strong indications for aphid spread on this location. Since then the Norwegian Food Safety Authority and Bioforsk have surveyed and tested samples from all commercial orchards all over Norway. PPV has now been found in all counties with commercial plum production (Blystad & Munthe 2006). Apricot and peach are not produced commercially in Norway, but are grown in private gardens in some of the southern areas of Norway.

PPV is the most damaging plum disease under European conditions. After its first discovery in Bulgaria (Antanassof 1933) it has spread to most European countries and is causing heavy losses in plum and apricot production in several countries (Roy & Smith 1994, Capote et al. 2006). So far there are no reports from other Nordic countries showing an extensive spread of PPV. Single cases have been reported in Denmark, but none from Sweden or Finland (Roy & Smith 1994, Lemmetty 2006)..

This publication gives an overview of the results from the survey for PPV in Norway up to the end of the season of 2008.

Materials and methods

The plum orchards in each district have been chosen according to official overviews over commercial plum orchards and from contact with the local extension officers. Private gardens were included in the survey in 1999, but as we found no infection in private orchards during this first year of the survey, the survey was concentrated on the commercial orchards in the following years.

All plum fields on a selected farm were inspected by officers from the Norwegian Food Safety Authority. From each field 15 trees were selected randomly and one leaf of each tree was collected. Subsequently, 5 leaves of each individual tree were combined into one sample. In addition, any tree showing typical PPV symptoms was sampled individually. If PPV was found in one or more combined samples from a farm, all plum trees on the farm were tested.

All samples were kept cool during storage and transport to the testing lab at Bioforsk. All samples were registered in a database. Detection of PPV was carried out by double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) using reagents bought from Bioreba and according to the manufacturer's descriptions. Strain identification of PPV was carried out as described in Cambra et al. (2006) and Olmos et al. (2006).

Results

Møre og Romsdal County: In this county altogether 23 farms have been surveyed and PPV has been found on 4 of them. Field observations indicate that PPV has most likely been spread by aphids in these farms. Large portions of the infected orchards have been eradicated to stop the spread. The survey and eradication is still ongoing in this county

Sogn og Fjordane: A total of 344 orchards and private gardens have been surveyed since 1998. PPV has been found on 20 farms (no cases in private gardens). Most infected trees have been of the cultivar 'Mallard'. All cases have been eradicated. The survey and eradication of infected trees have been an effective control of PPV in this county.

Hordaland: PPV has been found in 13 of 217 surveyed farms in Hordaland County. All these cases have been eradicated. The eradication of PPV in this county seems promising and successful.

Rogaland: Since 1998 a total of 50 farms have been surveyed. PPV was found on 9 of them. On 3 of these farms all infected trees were removed in 2000. However, in a subsequent inspection in 2006, newly infected trees were found on three farms. In 2008 no new infections were found. We hope PPV is now eradicated also from this county.

Aust-Agder: In this county PPV has been found in only one small plum orchard and has been eradicated.

Hedmark: Hedmark came relatively late into the survey, but 9 farms with commercial orchards were surveyed in 2007-2008. PPV was found in the orchards of two of the larger farms. The eradication work is ongoing.

Akershus: In this county PPV has been found in just one nursery and has been eradicated.

Buskerud: Altogether 43 farms have been surveyed. PPV was detected on 7 of them. Five of these cases were detected in the period 1998-2006. However, all were eradicated by 2007. In 2008 PPV was found on two new farms.

Vestfold: In this county PPV has been found on 4 of 25 farms surveyed since 1998. Most infected trees have been of the cultivars 'Herman' and 'Victoria'.

Discussion

During the course of this survey (1998-2008), we have found 852 PPV-infected trees among about 75 000 tested trees. In other words, about 1 % of the plum trees have turned out to be infected. In the period from 1998-2008 PPV have been found on 61 farms or nurseries, from which 5 of these were detected in 2007-2008. The eradication work have been successful in important counties such as Hordaland and Sogn and Fjordane. We believe that it is possible to eradicate PPV from Norwegian plum production as there are no wild *Prunus*-species in Norway functioning as a PPV reservoir for new infections. The peach aphid (*Myzus persicae*) does not survive our winters, so the most efficient vector for PPV is not important in Norwegian orchards. Our experience from this survey shows the importance of repeated inspections and sampling from infected orchards both to find newly infected trees and to find trees that might have escaped detection in the first inspection. Among the PPV strains occurring most often in *Prunus* spp (PPV-D, PPV-M and PPV-Rec; Candresse & Cambra 2006), the only strain so far detected in Norway is PPV-D.

Literature

- Atanasoff, D.; 1933: Plum pox. A new virus disease. Yearbook University of Sofia. Faculty of Agriculture 11, 49-69 (in Bulgarian).
- Blystad, D.-R.; Haugslie, S.; Ørstad, K.; Munthe, T.; Knudsen, R.; Hjeltnes, S.H.; 2007: An outbreak of Plum Pox Virus in Norway. *Acta Horticulturae* 734, 93-99
- Blystad, D.-R.; Munthe, T.; 2006: Plum pox virus (PPV) in Norway. *EPPO Bulletin* 36 (2), 212
- Capote, N.; Cambra, M.; Llacier, G.; Perre, F.; Platts, L.G.; Roy, A.S.; Smith, I.M. (eds); 2006: Current status of Plum pox virus and sharka disease worldwide. *Bulletin OEPP/EPPO Bulletin* 24, 36 (2), 205-218
- Cambra, M.; Boscia, D.; Myrta, A.; Palkovics, L.; Navrátil, M.; Barba, M.; Gorris, M. T.; Capote, N.; 2006: Detection and characterization of Plum pox virus: serological methods. *EPPO/OEPP Bulletin* 36, 254-261
- Candresse, T.; Cambra, M.; 2006: Causal agent of sharka disease: historical perspective and current status of plum pox strains. *Bulletin OEPP/EPPO Bulletin* 24, 36 (2), 239-246
- Lemmety, A.; 2006: Plum pox virus (PPV) in Finland. *Bulletin OEPP/EPPO Bulletin* 24, 36 (2), 208
- Olmos, A.; Capote, N.; Candresse, T.; 2006: Detection and characterization of Plum pox virus: molecular methods. *EPPO/OEPP Bulletin* 36, 262-266
- Roy, A.S.; Smith, I.M.; 1994: Plum pox situation in Europe. *Bulletin OEPP/EPPO Bulletin* 24, 515-523.
- Smith, I.M., McNamara, D.G., Scott, P.R. & M. Holderness (eds). 1997. Quarantine pests for Europe. Second edition. CAB International. 1425 pp