Incidence of Plum Pox Potyvirus in Jordan

Aydah Alnsour, Akel Mansour and Nida' Salem*

ABSTRACT

Field surveys of Plum pox virus (PPV) incidence in Jordan stone-fruit growing areas was conducted during 2007-2008. A total of 1847 samples were collected from commercial orchards, a mother block and nurseries. A total of 27 almond, 572 apricot, 126 cherry, 41 nectarine, 603 peach and 478 plum trees were tested individually for PPV by the double-antibody sandwich enzyme linked immunosorbent assay (DAS-ELISA). Around 4% of the tested samples were infected with PPV. The virus incidence in nectarine, plum, peach, cherry and apricot was 2.4, 3.1, 2.8, 3.1 and 6.1% of the tested trees, respectively. The level of viral infection was the highest in the mother block (7.4%), and the lowest in the samples from the commercial orchards (3.5%).

KEYWORDS: Survey, PPV, DAS-ELISA, Jordan.

INTRODUCTION

Stone fruits are one of the most important fruit trees in Jordan. The area cultivated with stone fruits trees is about 3803 ha, where peaches being the first, followed by apricot, plum, almond, cherry and nectarine, respectively (Anonymous, 2006).

Plum pox virus (PPV, Genus potyvirus, Family Potyviridae) also known as sharka, is considered one of the most serious diseases of stone fruits worldwide (Nemeth, 1986 and 1994) and severely reduces fruit yield and quality of prunus species including peaches, plums, apricots, almond, cherry and nectarine. The virus is transmitted by seeds (Nemeth and Kobler, 1983), vegetative propagative materials and is spread over a short distance by aphids in a non-persistent manner.

After the first report of sharka disease from Bulgaria in 1917 (Atanasoff, 1932), the virus is now widespread in Europe (Smith et al., 1992; Roy and Smith, 1994; Kalashyan et al., 1994). The disease was identified in the Mediterranean (Dunes, 1988; Kegler and Sutic, 1991; Al-Rawahni et al., 2000), North and South America (Levy et al., 2000a, b and c; Thompson et al., 2001; Herrea, 1994; Dal Zotto et al., 2006) and Asia (Kegler and Sutic, 1991; Navratil et al., 2005; Capote and Cambra, 2006).

For any effective control and management measures, it is essential to have information about the distribution of the virus, especially when this virus is known to have an active vector such as sharka disease. Since there is a lack of information about the situation of Plum pox virus in Jordan, this study was aimed at estimating the incidence and distribution of PPV in stone fruit orchards among the main production areas in Jordan.

MATERIALS AND METHODS

Field Surveys

Field surveys were carried out during the spring seasons of 2007-2008 in the main stone fruits growing areas in Jordan including Amman, Balka’a, Shoubak, Ma’an, Jerash and Tafila. Samples were collected from a) commercial orchards, b) mother blocks for bud-wood production (Tafila, Ma’an, Shoubak) and c) nurseries of stone fruits. Shoot samples with symptoms or symptom less leaves were randomly collected during spring seasons from different stone fruit trees. Samples were placed individually in labeled polyethylene bags and brought in an ice-chest to the Virology Laboratory at the Ministry of Agriculture.

Enzyme Linked Immunosorbent Assay (ELISA)

The Double Antibody Sandwich assay (DAS-ELISA) was performed as described by Clark and Adams (1977),

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using commercially available kits for PPV (Bioreba AG, Reinach, Switzerland). Two wells were used per sample. ELISA readings were considered DAS-ELISA positive when the absorption of sample wells was greater than at least twice the mean absorption reading of healthy control samples.

### Table 1: Incidence of Plum Pox Virus in different stone fruit trees from different locations in Jordan surveyed during 2007-2008 using DAS-ELISA

<table>
<thead>
<tr>
<th>Source of Tested Samples</th>
<th>Region</th>
<th>Peach</th>
<th>Apricot</th>
<th>Plum</th>
<th>Cherry</th>
<th>Nectarine</th>
<th>Almond</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mafraq</td>
<td>3/57a</td>
<td>4/48</td>
<td>0/24</td>
<td>-</td>
<td>1/16</td>
<td>-</td>
<td>8/145</td>
</tr>
<tr>
<td></td>
<td>Amman</td>
<td>0/76</td>
<td>2/48</td>
<td>0/43</td>
<td>3/25</td>
<td>-</td>
<td>0/2</td>
<td>5/194</td>
</tr>
<tr>
<td></td>
<td>Ajlun</td>
<td>0/75</td>
<td>0/70</td>
<td>0/96</td>
<td>0/21</td>
<td>-</td>
<td>-</td>
<td>0/262</td>
</tr>
<tr>
<td></td>
<td>Jerash</td>
<td>1/61</td>
<td>2/95</td>
<td>3/114</td>
<td>0/9</td>
<td>-</td>
<td>-</td>
<td>6/279</td>
</tr>
<tr>
<td></td>
<td>Balka’a</td>
<td>0/50</td>
<td>1/39</td>
<td>4/21</td>
<td>1/7</td>
<td>-</td>
<td>-</td>
<td>6/117</td>
</tr>
<tr>
<td></td>
<td>Shoubak</td>
<td>13/166</td>
<td>26/119</td>
<td>0/50</td>
<td>0/39</td>
<td>0/10</td>
<td>-</td>
<td>39/384</td>
</tr>
<tr>
<td></td>
<td>Tafila</td>
<td>0/65</td>
<td>0/113</td>
<td>0/45</td>
<td>0/25</td>
<td>-</td>
<td>-</td>
<td>0/248</td>
</tr>
<tr>
<td></td>
<td>Ma’an</td>
<td>0/53</td>
<td>0/40</td>
<td>8/85</td>
<td>-</td>
<td>0/15</td>
<td>0/25</td>
<td>8/218</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>17/603</td>
<td>35/572</td>
<td>15/478</td>
<td>4/126</td>
<td>1/41</td>
<td>0/27</td>
<td>72/1847</td>
</tr>
</tbody>
</table>

*a* No. of infected plants over no. of tested plants  
*b* Numbers in parentheses represent percentage of PPV infection

### Results

Field symptoms associated with *plum pox potyvirus* were difficult to observe and may be confused with other disorders such as the poor growth due to several factors including nutrient deficiencies. Infected apricot and plum trees showed clear symptoms on leaves during spring season. Infected prunus species as indicated by DAS-ELISA exhibited symptoms on leaves and fruits; leaf symptoms were light chlorotic spots and vein clearing (Fig. 1); fruits showed chlorotic spots or rings on flesh (Fig. 2) and rings or spots on stones (seeds) (Fig. 2). These symptoms were generally clear during spring season on the newly expanded leaves.

Field survey of stone fruit trees using ELISA tests revealed the presence of PPV in Jordan. Out of the 1847 samples collected during the survey, 72 samples (3.9%) were found to be infected with PPV. With respect to provinces, Shoubak has shown the highest rate of infection (10.1%) while the rate of infection in regions where PPV was detected ranged from 5.5% (Mafraq) to 2.1% (Jerash) (Table 1). However, the disease was not detected in Ajlun and Tafila regions (Table 1).

Regarding prunus species, apricots have scored the first rank level of infection (6.1%) while plums and cherries have shown the same rate of PPV infection (3.1%). The lowest rate of infection was associated with nectarines (2.4%) (Table 2). ELISA tests failed to detect PPV from almond samples. By comparing between prunus species within the region, apricot in Shoubak area had the highest rate of PPV infection (21.8%) whereas plums and cherries in Balka’a revealed the presence of PPV in high rates of infection (19% and 14.3%, respectively) (Table 1).

Irrespective of locations, mother block, nurseries and commercial orchards were found to be infected with PPV (Table 2). Mother block of peaches and plums showed...
the highest disease incidence while results of ELISA tests for commercial orchards indicated the lowest rate of PPV infection. With respect to nurseries, the virus was detected in apricots and cherries (Table 2).

### Table 2: Incidence of PPV in stone fruit trees, surveyed in Jordan irrespective of location, in commercial orchards, nurseries and mother blocks during 2007-2008 using DAS-ELISA

<table>
<thead>
<tr>
<th>Host plant</th>
<th>Commercial orchards</th>
<th>Nurseries</th>
<th>Mother block</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of infected plants over no. of tested plants.</td>
<td>Numbers in parentheses represent percentage of PPV infection.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apricot</td>
<td>13 /517 a</td>
<td>0/28</td>
<td>4/58</td>
<td>17/603</td>
</tr>
<tr>
<td></td>
<td>(2.5)b</td>
<td>(0)</td>
<td>(6.9)</td>
<td>(2.8)</td>
</tr>
<tr>
<td>Plum</td>
<td>33 /501</td>
<td>2/31</td>
<td>0/40</td>
<td>35/572</td>
</tr>
<tr>
<td></td>
<td>(6.6)</td>
<td>(6.4)</td>
<td>(0)</td>
<td>(6.1)</td>
</tr>
<tr>
<td>Cherry</td>
<td>7/419</td>
<td>0/19</td>
<td>8/40</td>
<td>15/478</td>
</tr>
<tr>
<td></td>
<td>(1.7)</td>
<td>(0)</td>
<td>(20)</td>
<td>(3.1)</td>
</tr>
<tr>
<td>Nectarine</td>
<td>1/95</td>
<td>3/31</td>
<td>-</td>
<td>4/126</td>
</tr>
<tr>
<td></td>
<td>(1.1)</td>
<td>(9.7)</td>
<td>(0)</td>
<td>(3.1)</td>
</tr>
<tr>
<td>Almond</td>
<td>-</td>
<td>0/2</td>
<td>0/25</td>
<td>0/27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
</tr>
<tr>
<td>Total</td>
<td>55/1573</td>
<td>5/111</td>
<td>12/163</td>
<td>72/1847</td>
</tr>
<tr>
<td></td>
<td>(3.5)</td>
<td>(4.5)</td>
<td>(7.4)</td>
<td>(3.9)</td>
</tr>
</tbody>
</table>

Discussion

In this survey, about 1847 trees were individually inspected for PPV infection in commercial orchards, mother blocks and nurseries. The association of characteristic symptoms with the presence of PPV was very difficult to observe due to nutrient deficiencies and
water shortage. This survey, which is the largest survey that has been conducted in Jordan so far, revealed the widespread of PPV in stone fruits as indicated by the infection of all Prunus species except almond in the surveyed locations. The absence of PPV in almond trees may be due to the low number of samples (27 samples). The incidence of PPV represents a high risk to the Jordanian stone fruit industry since the virus was detected in mother blocks, nurseries and commercial orchards. The results strongly revealed the absence of certification programs ensuring the production of virus-free propagative materials and lack of legislation for regulating the stands of nurseries and mother blocks in Jordan. Sharka is difficult to eliminate once it has been established in an area (Malinowski et al., 2006). Therefore, a program of disease control in which eradication of infected trees should be immediately implemented to stop the disease development (Dallot et al., 2003). Besides, a strict quarantine regulation and the necessity for a national certification program are highly recommended for this quarantine disease.

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