

## Aphid vectors of potato virus Y<sup>N</sup>

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### Abstract

Beside *Myzus persicae* a dozen other species were found to be vectors of potato virus Y<sup>N</sup>. Eleven other species did not transmit the virus.

'White Burley' tobacco and 'A6' potato are equally suitable as test plant to monitor the efficiency of *Rhopalosiphum padi* as vector of PVY<sup>N</sup>, but as PVY<sup>N</sup> source tobacco is not suitable for this aphid species.

Between some aphid species rather large differences exist in retention periods of PVY<sup>N</sup>. With *R. insertum* and *Aphis fabae* transmission after a 1 h starvation period was still 50% of that without starvation. With *Phorodon humuli*, *M. certus* and *M. persicae* this value was only 15, 30 and 30%, respectively.

*Additional keywords:* *Rhopalosiphum padi*, virus retention, virus transmission.

### Introduction

Earlier research (Van Hoof, 1977) showed that aphid species other than *Myzus persicae* also can play a role in transmitting potato virus Y<sup>N</sup> (PVY<sup>N</sup>) in potatoes, especially in the period before flights of *M. persicae*. Of the numerous aphid species active during that period, a number were tested for their capability to transmit PVY<sup>N</sup>.

Robert (1978) attributed the recent severe outbreak of PVY in France to the strong increase in population of *Rhopalosiphum padi*. In our experience and that of Kostiwi (1979) this aphid is not a very efficient vector. Rydén (1979), however, obtained rather high infection rates with this aphid when she used potato as test plant but no infection at all with tobacco as test plant. In both cases potato was used as a virus source. To find out whether our population of *R. padi* would behave similarly some trials were done.

Spread of PVY<sup>N</sup> over long distances depends on the retention period of the virus in the aphid. To test whether this period is different for the various aphid species, some species were studied.

### Materials and methods

The aphids used in our trials were either laboratory reared or collected in the field (cf Table 1). The aphids were always given a pre-acquisition starvation period of 3 h after which they were placed for 3–10 min on potato leaves taken from plants which were systemically infected with PVY<sup>N</sup>. Then the aphids were transferred in groups of five

to the test plant *Nicotiana tabacum* cv. White Burley and killed by an insecticide the next day. In all trials 50 tobacco plants were used. When 'White Burley' tobacco and 'A6' potato were compared as to their suitability as test plant, also systemically PVY<sup>N</sup> infected tobacco leaves were used as virus source and single-stemmed 'A6' plants as test plants.

Results and discussion

Table 1 shows the results obtained from 24 aphid species. It must be emphasized that these results are only relative. One cannot conclude that absence of virus transmission proves that the relevant aphid species is not a vector of PVY<sup>N</sup>. Examples are the results of the *Aphis pomi* trials. Specimens used in the first trial failed to transfer the virus to the 50 White Burley plants, but in a second trial with specimens collected from a different apple tree 9 out of 50 tobacco plants were infected. We worked with *Brachycaudus helichrysi* in two consecutive years. In all 190 tobacco plants were used and no virus transmission was detected. Nevertheless, Edwards (1963) obtained transmission of PVY in Northern Ireland with this aphid. Apparently the results of laboratory trials have only a relative value compared with those one can expect in the field. In the latter alatae usually will transmit the virus, whilst in the laboratory mostly apterae are used. Moreover, the vector in the laboratory has a limited choice of host plants.

In the fields aphids can be caught on strips of yellow cheesecloth. By putting them one by one on young tobacco plants in glass tubes immediately after capture, one can find out whether or not they carry virus. But even if they do, the question remains if the relevant aphids would have chosen a potato plant as their next host. In a preliminary trial in 1978 we found, following this method, that of the 160 specimens of *Capitophorus hippophaes* only one did transmit PVY<sup>N</sup>. Of the 326 specimens of *M. persicae*

Table 1. Percentages of PVY<sup>N</sup>-infection obtained with 24 aphid species. Mostly 100 or more plants were tested, unless stated otherwise.

<i>Acyrtosiphon Pisum</i>	14	<i>Brachycaudus helichrysi</i>	0
<i>Aphis fabae</i>	24	<i>Brevicoryne brassicae</i>	0
<i>Aphis pomi</i>	9	<i>Cavariella aegopodii</i>	0
<i>Aulacorthum solani</i>	5	<i>Cavariella theobaldi</i>	0
<i>Capitophorus hippophaes</i>	3	<i>Hyalopterus pruni</i>	0
<i>Macrosiphum euphorbiae</i>	29	<i>Hyperomyzus lactucae</i>	0 <sup>1</sup>
<i>Metopolophium albidum</i>	11	<i>Lipaphis erysimi</i>	0 <sup>1</sup>
<i>Metopolophium dirhodum</i>	3	<i>Microlophium carnosum</i>	0
<i>Myzus certus</i>	71	<i>Myzus ascalonicus</i>	0 <sup>1</sup>
<i>Myzus persicae</i>	50	<i>Nasonovia ribisnigri</i>	0 <sup>1</sup>
<i>Phorodon humuli</i>	35	<i>Sitobion avenae</i>	0 <sup>1</sup>
<i>Rhopalosiphum insertum</i>	50		
<i>Rhopalosiphum padi</i>	2		

<sup>1</sup> In these cases only 50 test plants were used.

Tabel 1. Percentage overdracht van PVY<sup>N</sup> verkregen met een 24-tal bladluissoorten. Meestal werden 100 of meer toetsplanten gebruikt.

Table 2. Transmission of PVY<sup>N</sup> by *Rhopalosiphum padi* using 'White Burley' tobacco and 'A6' potato as virus sources and test plants.

Virus source	Tobacco		Potato		
	Test plant	tobacco	potato	tobacco	potato
Trial 1		0/12	0/12	0/12	1/12
Trial 2		0/22	0/22	2/22	0/22
Trial 3		0/24	6/21	5/24	2/21
Trial 4		0/50	0/50	3/50	4/50
		0/108	6/105	10/108	7/105

Tabel 2. Overdracht van PVY<sup>N</sup> door *Rhopalosiphum padi* bij gebruik van 'White Burley' tabak en 'A6' aardappel als virusbron en als toetsplant.

three transmitted PVY<sup>N</sup>. The results of our trial shown in Table 1 indicate that our population of *C. hippophaes* was not very efficient in transmitting PVY<sup>N</sup>. Whether or not this inability has to be attributed to the method used or to this particular population remains a question.

In the spread of virus especially early flying aphids are important. The following species fly earlier than *M. persicae* and are also PVY<sup>N</sup> vectors: *Acyrtosiphon pisum*, *Metopolophium dirhodum*, *Myzus certus*, *Phorodon humuli*, *Rhopalosiphum insertum* and *Rhopalosiphum padi*.

The four trials with *R. padi* in which potato ('A6') and tobacco ('White Burley') were used as virus source as well as test plant (Table 2) showed that both plant species reacted similarly as test plants, but PVY<sup>N</sup> was not transmitted by *R. padi* when tobacco was used as virus source. In the third trial virus transmission was found, but the

Table 3. Transmission of PVY<sup>N</sup> to 'White Burley' tobacco by five aphid species after a 3–10 min acquisition period and different post-acquisition starvation periods.

Post-acquisition starvation period (h)	<i>Aphis fabae</i>	<i>Myzus persicae</i>	<i>Myzus certus</i>	<i>Phorodon humuli</i>	<i>Rhopalosiphum insertum</i>
0	8 <sup>1</sup>	20	25	14	24
1	4	6	8	2	14
2	1	3	4	1	5
4	0	1	0	1	2
6	0	0	0	0	0
8	— <sup>2</sup>	0	—	1	0
24	—	0	—	0	0

<sup>1</sup> Number of infected 'White Burley' plants out of 50 tested with 5 aphids per plant.

<sup>2</sup> Not tested.

Tabel 3. Overdracht van PVY<sup>N</sup> naar 'White Burley' tabak door vijf bladluisoorten. Na een virusopname van 3–10 min. werden ze aan verschillende vastperioden onderworpen.

numbers were so at variance with those obtained in the other three trials that an accidental infection must have occurred.

The results of trials in which the retention period of PVY<sup>N</sup> in five aphid species was established are shown in Table 3. It seemed that the ability to transmit PVY<sup>N</sup> decreased quickly after a starvation period, but there are distinct differences between the five species. Transmission was reduced to 50 % after a starvation period of 1 h in *R. insertum* and *A. fabae*. In *P. humuli* only 15 % of the initial ability to transmit virus remained after 1 h starvation. *M. persicae* and *M. certus* take an intermediate position. After a starvation period of 8 h virus transmission was once observed with *P. humuli*.

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### Samenvatting

#### *Bladluizen die vectoren van het aardappelvirus Y<sup>N</sup> zijn*

Van 12 bladluisoorten werd vastgesteld dat zij, evenals *Myzus persicae*, vectoren van het aardappelvirus Y<sup>N</sup> (PVY<sup>N</sup>) zijn. Van 11 andere soorten kon dit niet worden vastgesteld.

*Nicotiana tabacum* cv. White Burley en *Solanum tuberosum* cv. A6 bleken beide goed bruikbaar als toetsplant voor het vaststellen van de efficiëntie van *Rhopalosiphum padi* als vector van het PVY<sup>N</sup>; voor deze bladluisoort is tabak ongeschikt als bron van PVY<sup>N</sup>.

De retentieperiode van het PVY<sup>N</sup> lijkt bij verschillende bladluisoorten aanzienlijk te variëren. Bij *Rhopalosiphum insertum* en *Aphis fabae* bracht één uur vasten na de acquisitie de overbrenging terug tot 50 % van die welke zonder vasten werd verkregen. Bij *Phorodon humuli* was de reductie in overbrenging na één uur vasten 85 %, bij *Myzus certus* en *M. persicae* was deze 70 %.

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