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INCIDENCE OF POTATO VIRUS "Y" AND APHID FLIGHTS IN POTATO (BRAŞOV, 2014-2016)

Carmen Liliana Bădărău[1*, 2], Daniela Donescu[1], Sorin Claudian Chiru[1], Victor Donescu[1]

[1]National Institute of Research and Development for Potato and Sugar Beet 2 Fundăturii, 500470 Braşov, Romania

[2]Faculty of Food and Tourism, Transilvania University from Braşov, 148 Castelului, 500014 Braşov, Romania

[*]Corresponding author. E-mail: badarau_carmen14@yahoo.com

ABSTRACT

This study aimed to provide updated information on incidence of PVY in seed potatoes (Carrera, Red Lady, Hermes, Riviera, Christian and Roclas varieties) produced in trials at Braşov, where the aphids flight was monitored three years (2014, 2015 and 2016). Another goal of this research was to identify the symptoms of PVY infected material, find positive by ELISA tests in the previous year's crops. The highest level of PVY and PVY^N infection was observed in 2015 for all potato varieties planted in the lot trials. In 2015, the periods of prolonged drought in July and August were responsible for the high incidence of PVY in the potato trials studied, compared with the infection level of the material in the other two years (2014 and 2016). There were some deviations in 2015 concerning to abundance and dynamics of aphid population, potentially PVY vectors. The peak period for aphid attack was the third decade of May - the first decade of June, a very vulnerable period for potato crop. In this year, aphid activity significantly offset the general trend. Experiments conducted in Braşov indicate that many PVY infected plants did not visually express symptoms and could be a good inoculum ready for the time when aphids vectors are typically at their highest levels.

Key words: potato virus Y, aphids, structure, abundance, dynamic.

INTRODUCTION

Virus diseases have long been a primary focus of the certification effort in potatoes and many years, the potato viruses were kept at low levels. In the last three decades, Potato Virus Y (PVY, *potyvirus* genus, family *Potyviridae*) has made a major resurgence as one of the most problematic viruses in Romanian seed potatoes lots, due its frequency and damaging potential (Bădărău et al., 2012). This virus occurs worldwide and the crop production with secondary infection can be reduced with 33-90%, depending on potato variety and virus strains (Cojocaru, 1987). De Bokx and Huttinga (1981) stated that the PVY infections can reduce yields by 10-80%. Similarly, a reduction in marketable yield of 65% in Russet Norkotah was reported by Hane and Hamm (1999). Nolte et al. (2004) studied the effect of tuber borne PVY infection on Russet Burbank, Russet Norkotah and Shepody and reported a yield loss of 0.18 tones/ha for each 1% increase in PVY infection.

PVY is responsible for serious decreases on yield and quality, but the main problem in seed potato production is the requirement for a strict PVY tolerance limits for certified seed lots. High levels of PVY are responsible for the rejection of many seed potato lots. A significant reduction of the crop value was noticed and was reflected in a certified seed shortage, too, especially for certain potato varieties highly susceptible to PVY infection (Gray et al., 2010; Lacomme et al., 2014). The national certification scheme involves sanitation measures such as monitoring aphid populations, field inspections associated with visual detection, roguing of infected plants and post-harvest testing. Despite all these protection measures, massive imports of potato in last decades, the continuous "migration" of seed potatoes from one area to another, climate change, inadequate treatments for disease vector control (especially aphids), viral pressure and insufficient resistance of varieties, are just some of the factors that may favour the spread of aggressive strains of this virus.

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PVY can be spread by many species of aphids (plant-sucking insects that can produce direct damage by feeding on sap and decreasing plant performance or, indirect damage by transmitting viruses). Important aphid species feeding (colonizing) on potatoes are: the peach-potato aphid (*Myzus persicae*) (Sulzer); foxglove aphid (*Aulacorthum solani*) Kaltenbach; potato aphid (*Macrosiphum euphorbiae*) (Thomas); buckthorn aphid (*Aphis nasturtii*) Kaltenbach; black bean aphid (*Aphis fabae*) Scopoli and alder buckthorn aphid (*Aphis frangulae*) Kaltenbach. Other species potentially virus vectors not feeding on potato (non-colonizing) are the following: bird cherry-oat aphid (*Rhopalosiphum padi*) (Linnaeus); pea-aphid (*Acyrthosiphon pisum*) (Harris); leaf-curling plum aphid (*Brachycaudus helichrysi*) (Kaltenbach); hop-aphid (*Phorodon humuli*) (Schrank). More than 50 aphid species are vectors of PVY virus on potatoes and their number increases every year. The most important aphid pest is peach-potato aphid (*Myzus persicae*), which is capable of transmitting or spreading over 100 viruses including Potato Virus Y.

Aphids transmit PVY on potato crops in a non-persistent manner (Peters, 1987). Within minutes of starting to feed on a PVY potato infected plant, the virus particles get stuck in the aphid's stylet (Altaf et al., 2016). If the aphid moves than to a healthy potato plant and soon starts to feed, the virus particles are transmitted to the healthy plant (Peters, 1987; Martin et al., 1997). The vector loses its ability to transmit relatively quickly after acquiring it from an infected plant (Peters, 1987). The virus has been acquired while probing and the aphid is immediately able to transmit it in subsequent probing (Peters, 1987). Transmission may take only few seconds or minutes and the stylets remain infective maximum two hours (Peters, 1987; Altaf et al., 2016). Once an aphid finds a suitable plant species, it simultaneously feeds and reproduces (Martin et al., 1997). Infestations with these insects can build to severe levels very rapidly because the reproduction is faster than in any other insects (Altaf et al., 2016). The life cycle of aphids is unusual and very complex (Peters, 1987; Martin et al., 1997; Powell, 2005). Due this complicated life cycle of the pathogens, controlling aphid vectors that spread PVY on crops is very difficult. There were varying successes utilizing border crops, different filed configurations to help isolate earliest generation material, crop oils etc. (Radcliffe and Ragsdale, 2002). However, because of the rapid spread of this non-circulative, stylet borne virus by numerous species, these practices have limited impact. Numerous growers have utilised a spatial approach to planting, where the most susceptible cultivars are planted within the field, away from the borders and inside of less susceptible type cultivars. In Braşov, this has shown excellent success with smaller lots, but tends to decrease in effectiveness as lots increase in size [non published data]. Other growers have utilized isolated field removed from the major production areas as a solution. Again, this has had some good success under Braşov conditions, but is not always the solution. Additionally, use of planting date manipulation, that is early planting and early vine kill to avoid the times of the season when aphid vector number is highest, can work under ideal conditions, but is more limited if there are high number of non-potato type aphides which can spread PVY, even with lower transmission rates.

Another potential factor that fuelled the resurgence of PVY in the last years was the area increase of several cultivars that exhibit latent symptoms or transient symptoms (plants which express visual symptoms only at certain times of the season, depending upon environmental factors, level of nitrogen in crop, or decrease in virus titre as the season progresses). So, infected stocks were typically not recognised as infected by either certification officials or the growers, but acted as reservoir for PVY and provided a good inoculum for rapid aphid transmission of the virus to previously non-infected stocks. In this situation, many of the cultivars grown in the last 3 decades and into the present are quite susceptible to PVY infection and have proven difficult to keep virus levels low during the late season.

Therefore, because certain species of aphids are vectors of major PVY viruses and in different years have increased their numbers, monitoring the abundance and species composition of aphids is important. It is the reason why we proposed this study that aimed to provide an updated information on incidence of PVY in seed potatoes (for several cultivars) produced in lots trials from Braşov, where the aphid flights were studied in the last three years (2014, 2015 and 2016). Another objective of this research was to identify the symptoms development in the PVY infected material found positive by ELISA in the previous year's crops.

MATERIAL AND METHODS

Biological material. The potato samples tested originated from 6 cultivars (Table 1) planted in experimental fields (GPS: N 45° 63′ 95.93", E 25° 51′ 29.79") in Braşov in the last three years (2014, 2015 and 2016). Each year, the experiment was a split-plot design with three replications, using the following varieties:

- Carrera, Red Lady, Hermes, Riviera (popular cultivars for the Romanian potato producers);
- Christian, Roclas (Romanian varieties).

Before planting and at emergence, the biological material was PVY virus free. PVY infectors (breeding line 1876/1, secondary infection PVY^N) were used.

The material was tested post-harvest, to estimate the percentage of PVY and PVY^N infection in tubers, the distribution of these pathogens (primary infection) in the material.

After that, the infected material was tested for symptom development during the vegetation period in 2 years (2015 and 2016). Each lot was derived from the PVY infected samples obtained from the previous year's crop (for example the material found PVY infected in 2014 was planted in 2015).

Every emergent plant within each lot was tested for PVY by ELISA at about 15 cm tall and infected plants were tagged and visually observed for mosaic symptoms during the vegetation period.

All field visually observed mosaic plants were confirmed as PVY positive by ELISA at the time of observation. Visual readings were taken within each lot after four different vegetation periods:

- 50 (in 2015), 47 (in 2016) days after planting (DAP);
- 55 DAP (in 2015), 52 DAP (in 2016);
- 78 DAP (in 2015), 69 DAP (in 2016);
- 82 DAP (in 2016).

Climatic conditions. Weather conditions (rainfall and air temperature) during the potato vegetation period are presented in Table 2.

Table 2. Weather conditions in potato vegetation period in the years 2014-2016 (sum of rainfalls and of temperatures)

Year	Months						
	IV	V	VI	VII	VIII	IX	IV-IX
Rainfalls (mm)							
2014	117.9	94.4	76	115.4	60.6	34.4	498.7
2015	28	44.8	175.6	42.4	22.6	111	424.4
2016	98.4	100.4	121.2	28.8	85.8	38	472.6
Mean 2007-2017	58.4	81.2	109.2	88.8	67.6	52.4	457.6
Temperatures sum (°C)							
2014	273.9	416.2	491	597.7	579.8	427.6	2786.2
2015	238.4	467.9	520	643	615.6	502.4	2987.3
2016	339.1	383.5	570.7	610.8	571.2	450.2	2925.5
Mean 2007-2017	283.7	422.5	527.2	617.2	586.9	460.1	2897.6

Detection of PVY infections. The analysis was performed following the protocol Clark and Adams (1977). Rinsed microplates filled with substrate solution (p-nitro-phenyl-phosphate) were incubated one hour and the absorbance values were estimated at 405 nm (A_{405}) using a Tecan SunRise reader (software Magellan). The samples that have A_{405} values exceeding the cut-off (two times the healthy control samples average) were considered PVY infected. The material was tested for 6 viruses (Potato virus Y, Potato Leaf roll Virus, Potato virus M, Potato virus X, Potato virus S and Potato virus A) and we kept the PVY infected material, for identifying the samples infected with necrotic strains. This biological material was retested using monoclonal antibodies (mAb) or polyclonal antibodies (PCA). The microplates were coated with anti PVY-NOC mAb (Bioreba, Switzerland, antibodies that could recognize all the PVY strains, except the PVY^{O}) and the virus was detected using alcalin phosphatase (AP) linked to anti–PVY-NOC mAb (Bioreba, Switzerland, specific for the strains Y^{N}) or linked to anti- PVY-NOC mAb (Bioreba, Switzerland). Number of the samples tested in the three years is presented in Table 2.

Table 2. Number of PVY and PVY^{N} infected samples from the total material studied and collected in 2014, 2015 and 2016 (field experiments, Braşov)

Year / Variety	Number samples tested / Number samples PVY infected / Number samples PVY^{N} infected		
	2014	2015	2016
Christian	85 / 1 / 0	85 / 2 / 0	82 / 0 / 0
Roclas	89 / 4 / 1	89 / 10 / 1	90 / 2 / 0
Carrera	93 / 46 / 29	90 / 68 / 52	82 / 32 / 18
Red Lady	94 / 24 / 12	90 / 42 / 28	74 / 28 / 12
Hermes	93 / 31 / 20	90 / 52 / 38	82 / 17 / 8
Riviera	96 / 0 / 0	95 / 0 / 0	89 / 0 / 0
TOTAL	540 / 106 / 62	539 / 174 / 119	499 / 79 / 38

Aphides sampling. Captures of winged aphids in yellow water traps were monitored daily for three years consecutively (2014-2016) in the potato field at Braşov. The use of yellow traps can give the numbers of aphids, which can be related to dispersal and redistribution of aphid populations. Two yellow traps were set in potato fields immediately after the emergence of potatoes (May), till the second decade of August. They were one-third filled with water with the addition of few drops of liquid detergent which prevent aphids from flying away. At the beginning the traps were placed directly on the ground, but during vegetation they were elevated in order to be visible for flying aphids. Every day, winged forms of aphids were collected and specimens were preserved in 70% ethanol until identification. Several keys were used to identify the species: Blackman & Eastop (1984), Blackman & Eastop (2000) Taylor & Robert (1984), Remaudière & Autrique &, Eastop, Starý & Aymonin & Kafurera & Dedonder (1985); Jacky & Bouchery (1984).

Using the data collected, dominance index of each aphid species was estimated dividing the number of individuals of one species by the total number of individuals, and multiplying by 100. The values obtained were classified as: accidental, where species represented 0.0 to 2.5% of total aphids; accessory, where species represented 2.6-5.0% of the total aphids; and dominant, where species represented 5.1-100% of the total aphids caught.

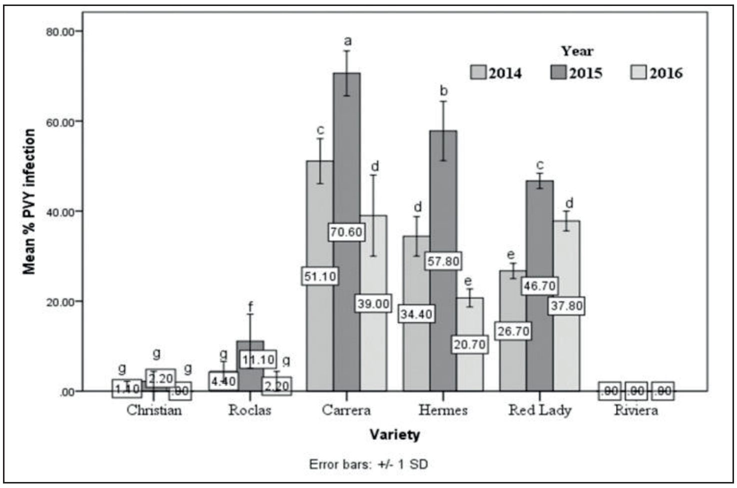
Statistical interpretation. Analysis of variance (ANOVA) and Duncan's multiple range test were used for interpretation the data.

RESULTS AND DISCUSSION

PVY incidence in experimental lots (Braşov). In the figure 1 A&B&C present the level of PVY and PVY^N infection of the material collected from the field trials in Braşov during the last three years. The lowest value of the PVY infection level in the harvested material was observed for the samples collected from varieties Riviera, Christian and Roclas in 2016 (0% to 11.1%) and the highest in 2015 for variety Carrera (70.60%) (Figure 1A).

On the other hand, for Hermes variety, the percent of infection rates in 2015 was 2.8 times higher than in 2016.

A.



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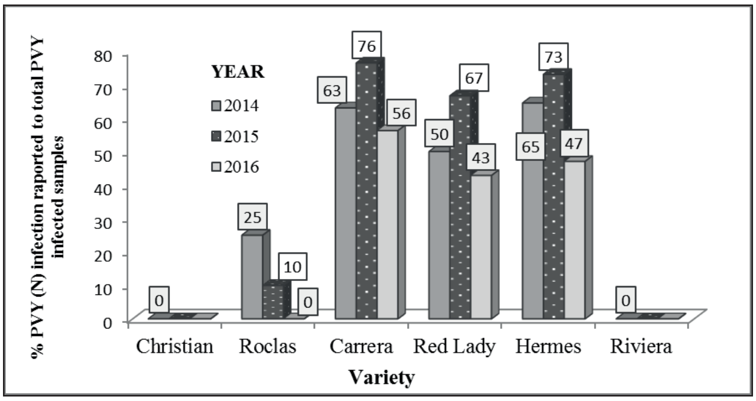

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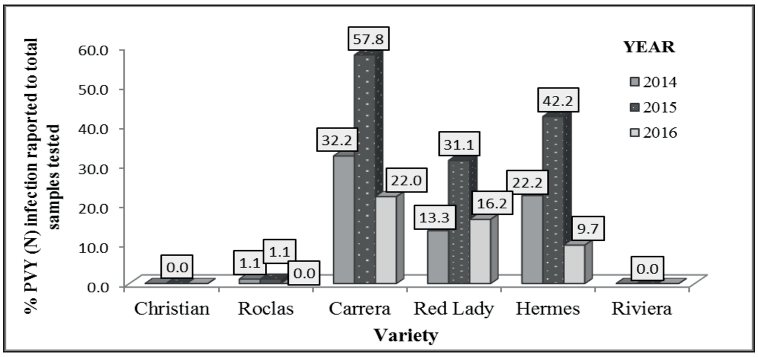

Figure 1. Percentage of PVY and PVY^N infection in 2014, 2015 and 2016 in Braşov (in function of the varieties tested every year)

[(A) % PVY infection (mean values for three replications). Values not followed by the same letter are significantly different (p=0.05) according to Duncan's test.] Abbreviation: D = standard deviation;

[(B) % PVY^N infection (samples PVY necrotic infected reported to total material tested)];

[(C) % PVY^N infection calculated from PVY infected material (samples PVY^N infected reported to total PVY infected samples)].

PVY Infection percentage was also high for variety Red Lady in 2015 (46.67%) (Figure 1A). On the whole, in all the years, there were significant differences depending on the sampled varieties (Figure 1A). The reduced values obtained for total % PVY infection of the biological material collected in 2014 (19.63%) and 2016 (15.8%), compared with the level of PVY infection of the material tested in 2015 (32.23%), using the similar varieties were interesting (Figure 2A).

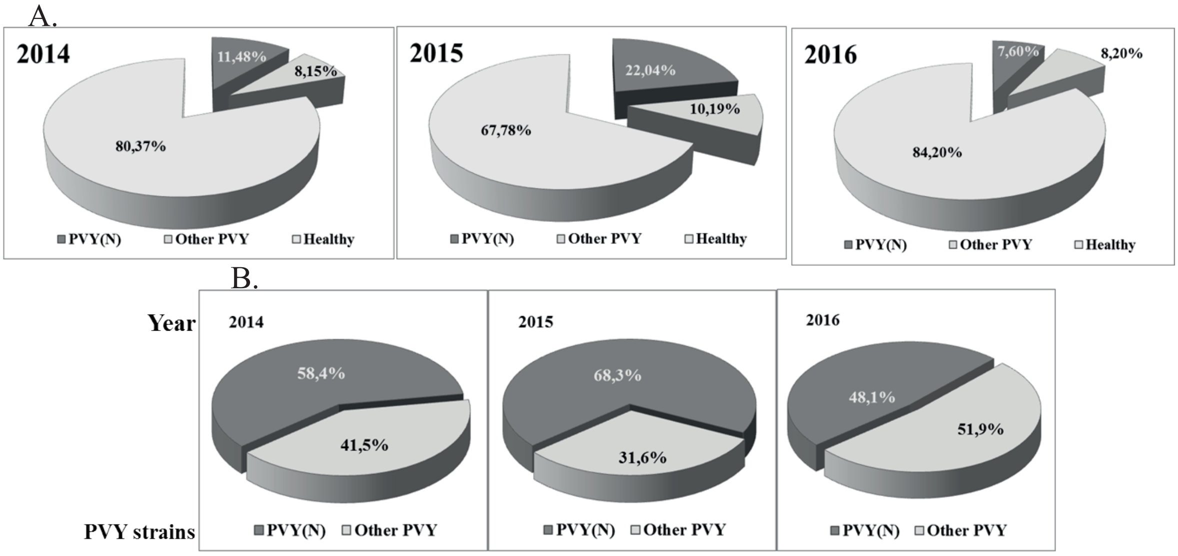

Figure 2. Distribution of PVY and PVY^N infection of the material tested in 2014, 2015 and 2016 in the experimental lots in Braşov
[(A) Percentage of PVY^N and of the other PVY strains in the trial fields reported to all the samples tested. (B) Percentage of PVY^N infection of the samples reported to the PVY infected material find in each year of the experiment]

Table 3. Comparative screening for the presence of PVY based upon ELISA and visual readings during 2 years of testing in field experiments (Braşov)

Variety	ELISA (number plants PVY infected planted/ Total plants tested in the previous year crop)	Visual[1] (days after planting coupled with percentage of plants PVY infected after each interval)						Percent and visually at end of the vegetation period
Year 2015		50 DAP[3]	55 DAP	%	78	%	NT[2]	%
Christian	1 / 85	0	0*	0	1	100		
Roclas	4 / 89	2	1	75	1	100		
Carrera	46 / 90	32	6	82.6	8	100		
Red Lady	24 / 94	20	2	91.7	2	100		
Hermes	31 / 93	21	3	77.4	7	100		
Riviera	0 / 96	NT	NT	NT	NT	NT		
Year 2016		47 DAP[3]	52 DAP	%	69 DAP	%	89 DAP	%
Christian	2 / 85	0*	1	50	0	50	1	100
Roclas	10 / 89	4	2	60	3	90	1	100
Carrera	68 / 90	34	17	75	14	88.2	3	100
Red Lady	42 / 90	29	4	78.6	8	97.6	1	100
Hermes	52 /90	36	5	70	10	98.1	1	100
Riviera	0 / 95	NT	NT	NT	NT	NT	NT	

[1]Plants were scored as visual mosaic at each time interval with only new plants being added after the initial readings. For example in year 2015, for variety Carrera, 68 plants out of 90 were found ELISA positive for PVY. In the next year (2016), this material was planted again and at 47 DAP, 34 plants were visually infected. At 52 DAP, another 17 plants were positive resulting 51 with visual symptoms for a 75% rating. At 69 DAP another 14 were + for 65 out of 68 or 88.2%. At 89 DAP a final 3 were + representing 68 out of 68 scored positive by ELISA and visually in the field or 100%.
[2]NT = not tested; [3]DAP = days after planting when the first inspections and ELISA tests were made.
*Visual positive but ELISA negative.

Interesting values were found too, for the total % PVY^N infection calculated from total samples PVY infected in 2014 (58.4%) and 2016 (48.1%), significantly lower compared with the percentage observed in 2015 (68.3%) (Figure 2B). Regarding the PVY and PVY^N infection level of the material tested in all the years, the highest infection level with necrotic strains of PVY was noticed in case of cultivars Carrera, Hermes and Red Lady (Figure 1A&B&C).

Experiments conducted in Braşov indicated that PVY expression in field for the cultivars studied is often transient or latent and will not express during the growing season that is appropriate for roguing infected plants. Table 3 indicates how the lots performed in terms ELISA testing versus visual readings. It is apparent that many PVY infected plants did not visually express the symptoms until well after effective roguing could take place. In both years, this left a good percentage of the plants which either expressed quite late into season or never showed a visual expression during the season. This tendency to express late symptoms or latent symptoms provides a base of inoculum which is available in the later period, ready for the time when aphides vectors are typically at their highest levels.

Finally, certification programs have long used low disease tolerance as mechanism for keeping virus levels low in the field (Knutson, 1998). The problem with this approach has been that the most susceptible cultivars tend to be the ones most easily rejected from certification. This, in turn, limits the amount of seed available for replant, which puts pressure on the system and the growers themselves to plant back less than satisfactory seed lots. As result, the reservoir for PVY can be quite high in the commercial potato crops, putting more pressure on the seed certification systems to keep PVY out of their seed. This cycle can be broken through the use of laws promoting the planting of only certified seed potatoes for the entire region, certified seed growers using all the production and management options available to help control the spread and level of PVY in their seed operations and the use of more resistant cultivars that have the appropriate horticultural characteristic for good marketing. Very important for the seed potato growers are the knowledge about aphides abundance, efficiency of transmission, environmental factors (climatic conditions, virus sources, host-plants) factors that could influence the virus transmission rate.

Aphides flights in experimental lots (Braşov). During three years, 3858 aphid’s individuals were caught and identified. Thirty-nine aphid species or species groups were identified from yellow traps in 2014, forty-nine in 2015, and forty in 2016. Twenty-three species were commonly caught during monitoring years.

In 2014, 698 individuals belonging to thirty-nine species or species-group were caught. The dominance of aphid species was as follow: 34 accidental and 5 dominant species. The dominant species were: *Aphis craccivora* (5.15%), *Aphis fabae* (29.94%), *Aphis frangulae* (13.46%), *Aphis sambuci* (8.59%), *Aphis* spp. (8.45%) and *Brevicoryne brassicae* (13.18%). Aphid species that colonize and reproduce on potato are efficient PVY vectors. Colonizing species included green peach aphid (*Myzus persicae*), potato aphid (*Macrosiphum euphorbiae*), and buckthorn aphid (*Aphis nasturtii*). Although green peach aphid is the most efficient vector of PVY in potato, several non-colonizing species contribute to PVY prevalence also (Ragsdale et al., 2001). Non-colonizing aphid species do not reproduce on potato, but may transiently visit potato plants. Such species can occur in very large numbers, making their effect on virus spread large, despite their lower virus transmission efficiency (Halbert et al., 2003). Non-colonizing or transient aphids will “taste” plants as they move through a potato field in search of a preferred host and can pick up and transmit PVY.

During potato vegetation, abundance of the two potato-colonizing species, green peach aphid (*M. persicae*) and potato aphid

(*M. euphorbiae*) was negligible relative to non-colonizing species. These species were accidental, with a dominance of 0.85% and 0.42% respectively.

Flight activity of aphid populations in potato is presented in Figure 3A. In 2014, aphid flight began in April - May, aphid abundance peaked in first decade to mid July. In May 22 species (83 individuals), in June-25 species (216 individuals), in July-23 (343 individuals) and in August-17 (53 individuals) were identified. Flight diagram of most abundant species caught in 2014 – *A. fabae, A. frangulae* and *B. brassicae* is presented in figure 4B. Flight of these species intensified from the first and second decade of July. Of the aphid species caught and identified, the most part (94.12%) represents a potential threat for PVY virus transmission in potato crop (Figure 4).

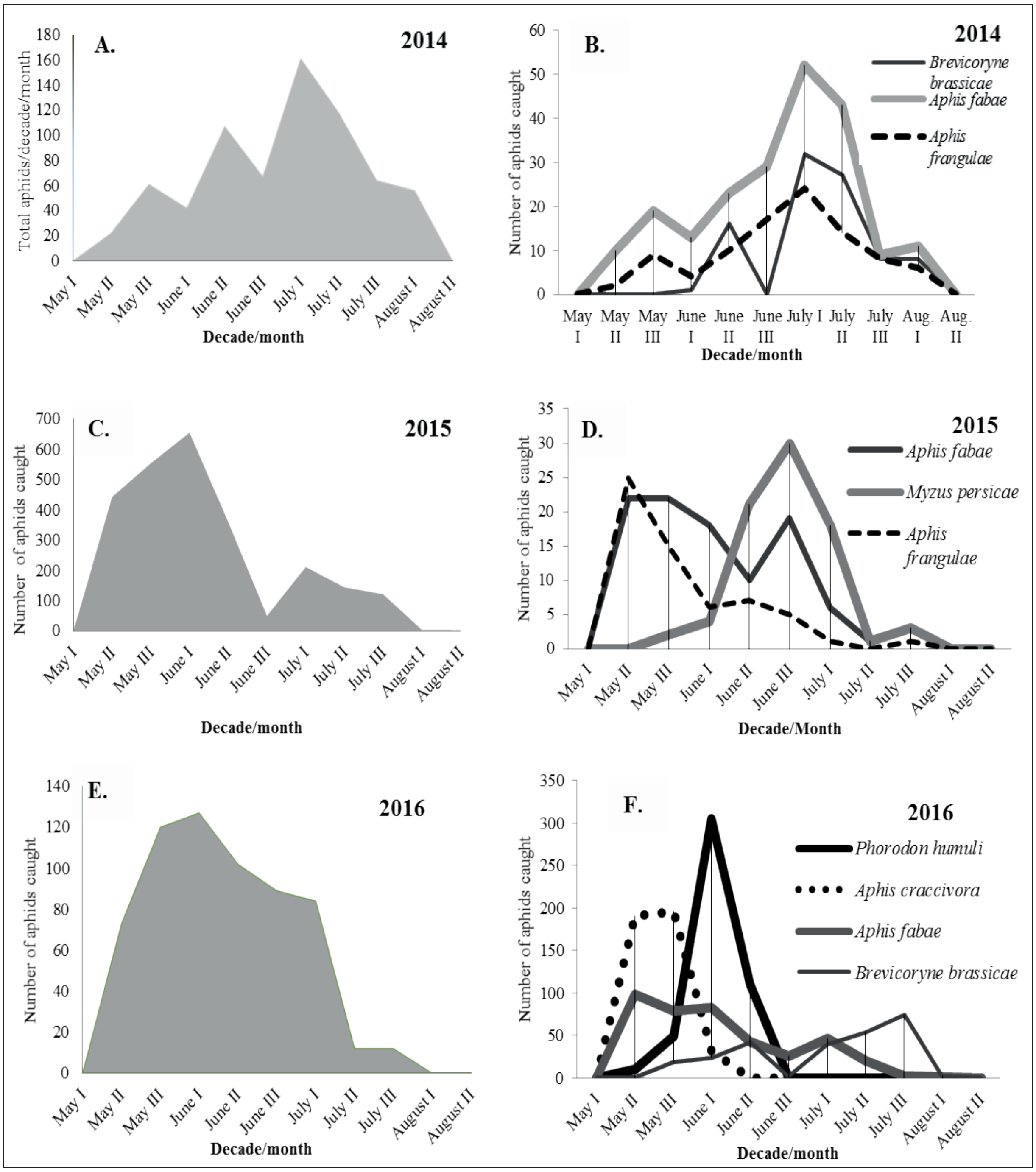

Figure 3. Flight activity of aphid population in potato crop at Brașov in 2014 (A) in 2015(C) and in 2016 (E) [Flight activity of most abundant aphid species in 2014 (B) in 2015 (D) and in 2016 (F)]

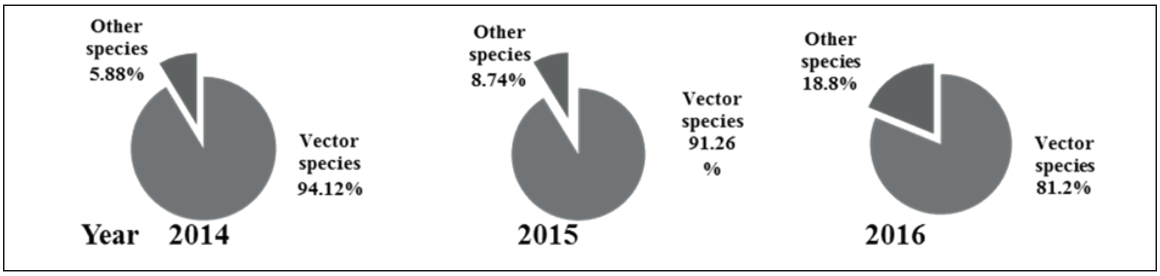

Figure 4. Relative dominance of vector species comparatively with other species identified in potato crop during the last three years (2014, 2015 and 2016)

In 2015, the largest number of aphids was found (forty-nine aphid species with 2541 specimens). Among them, 40 species were accidentals, 3 accessories and 6 dominants. The most abundant and dominant species were: *A. craccivora* (16.45%), *A. fabae* (15.70%), *Aphis frangulae* (8.81%), *Brevicoryne brassicae* (10.11%) and *Phorodon humuli* (18.65%). The main vector of all potato viruses, *M. persicae,* had accidental dominance (0.97%) and *M. euphorbiae* (0.07%) was accessory. Fluctuation of aphid populations indicated that they were abundant and flew actively in mid-May – first and second decade of June, with a peak in the second decade of June. The maximum aphid flight activity in potato crop and maximum vector activities started early, on the second decade of May-second decade of June (Figure 3D). *A. craccivora* and *A. fabae* were most active on mid-May, and *P. humuli* in early June. In this period, in our climatic area, potato is in early stage of vegetation, being thus very vulnerable to virus infections. If massive infections of seed potato crops occur at the beginning of the growing season, inevitably they lead to massive plant and tuber infestation. At that stage of PVY infection, the virus is translocated to tubers faster, and tubers become infested already at the setting stage. Potential vectors of PVY catches, accounted for 91.26% of the total amount of aphids identified (Figure 4).

In 2016, we identified forty aphid species with an abundance of 619 individuals. 30 aphid species were accidentals, 2 species accessories and 8 species dominants. Aphids were caught starting with the second decade of May until the first decade of July. Potentially viral activity of these insects covered May and June, months of beginning of the potato crop vegetation (Figure 3E). Most abundant and dominant were the following species: *A. fabae* (16.31%), *M. persicae* (12.76%), and *A. frangulae* (9.69%). The three dominant species had a different activity during the vegetation period. *A. fabae* was very active since the second decade of May to the third decade of June. *A. frangulae* flew intensively in May and June, and the main vector of potato viruses *M. persicae* was very active throughout the month of June until the first decade of July. Practically, on the entire potato vegetation period, aphid species known as potentially vectors of potato viruses were active (Figure 3F). Most of the aphids (81.2%) represented a potential threat for PVY virus transmission in potato crop (Figure 4).

The population fluctuation and flight activity of aphids vary during the years, because they are affected by numerous biotic and abiotic factors (rains, winds, variations in temperature, presence or lack of food). The results obtained suggested that PVY prevalence in the potato fields increased following these increases in aphid abundance. Interesting were the important contribution to PVY prevalence in potato of *P. humuli* and of other species, especially in year 2015. There were some strange deviations in 2015 concerning to abundance dynamics of PVY vectors aphid population. The peak period for aphid attack was the third decade of May - the first decade of June, a very vulnerable period for potato crop. In this year, aphid activity significantly offset the general trend. Maybe, the mild climatic conditions of previous winters, or the periods of prolonged drought in July and August were responsible for the highest incidence of PVY in the potato trials studied in 2015, compared with the PVY infection observed in the other two years (2014 and 2016).

In summary, PVY in all its facets will be around for the foreseeable future. Growers must take the opportunity to understand this virus, how it is spread, and the propensity for new strains in the virus population. Then, they must take specific steps to help manage this virus in their crop. Many of the steps and pitfalls have been outlined in this article. It is only through aggressive management and reduction of inoculum that growers will see ultimate success in managing this virus problem.

CONCLUSIONS

Virus transmission rate is dependent on many factors: aphid abundance, the efficiency of transmission, environmental factors (climatic conditions, virus sources, host-plants).

The highest level of PVY and PVY^N infection was noticed in 2015 for all the varieties planted in the lot trials. The periods of prolonged drought in July and August were responsible for the high incidence of PVY in the potato trials studied in 2015, compared with the infection level of the material in the other two years (2014 and 2016).

There were some deviations in 2015 concerning to abundance dynamics of aphid population PVY vectors. The peak period for aphid attack was the third decade of May - the first decade of June, a very vulnerable period for potato crop. In this year, aphid activity was significantly offset the general trend.

Regarding the PVY and PVY^N infection level of the material tested in all the years, the highest infection level with necrotic strains of PVY was noticed in case of cultivars Carrera, Hermes and Red Lady.

Experiments conducted in Brașov indicated that PVY expression in field for the studied cultivars is often transient or latent and will not express during the part of the vegetation period that is appropriate for roguing infected plants. Many PVY infected plants that did not visually express symptoms until well after effective roguing could be a good inoculum ready for the time when aphides vectors are typically at their highest levels.

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