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Aphis frangulae Kaltenbach, 1845 on potato crop in 1970-2005 and the ongoing changes

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Introduction

Aphids are the most important potato virus vectors. Therefore, they are significant in the economy, and especially in seed potato production since virus diseases constitute the major cause of degradation and disqualification of seed plantation.

Apart from the necrotic tobacco leaf carling virus (*Tobacco Rattle Virus* TRV), the vectors of which are 'stubby-root' nematodes and potato X virus which is transmitted in a mechanical way, the insects are responsible for the transmission of all the viruses which infect potato plants including potato virus Y (*Potato Virus Y*, PVY), potato virus M (*Potato virus M*, PVM), potato virus S (*Potato Virus S*, PVS) and potato leafroll virus (*Potato Leaf Roll Virus*, PLRV).

Species composition of aphids which occur on potatoes in Poland were presented for the first time by Siemiaszko (1952), who distinguished the following species: *Myzus persicae* (Sulzer, 1775) (the only PLRV virus vector of economic importance, a very effective PVY vector and a weaker PVM and PVS viruses vector); *Aphis nasturtii* Kaltenbach, 1843 (very effective vector of PVY and PVM and weaker vector of PVS); *Aphis frangulae* Kaltenbach, 1845 (vector of PVY and PVM, possibly transmitting PVS too), *Macrosiphum euphorbiae* (Thomas, 1879) and *Aulacorthum solani* (Kaltenbach, 1843). The two latter species are vectors of PVY, PVM, PVS and PLRV. Since that time the composition has not changed but as the results of the following research proved

there are changes in terms of quantity. For instance the number of *M. persicae* increased (Gałecka, 1978; Wisłocka & Kostiw, 1978; Kostiw, 1987).

The aim of the many years of monitoring was to obtain information on the time of spring migration and number dynamics of *A. frangulae* aphids and to find out weather there have been any changes in this respect.

Material and methods

Observations on aphids were carried out in 1970-2006 in 4 towns located in different regions of the country (Fig. 1.): Bonin in the Pomerania region, Szyldak in the Warmia-Mazurian region; Jadwisin in the Mazowieckie region and Stare Olesno in the Opolskie region. Every year aphid monitoring was carried out from May until August. Insects were caught into 2 yellow dishes 3/4 filled with water and 2-3 drops of liquid which softened the surface tension of the fluid. Dishes were placed on a square-shaped black ground, the side of which was 20 m. It was surrounded by a potato field. The dishes were emptied generally on daily basis around 8 a.m. The collected material from each dish separately was stored in 70% alcohol. Aphids were identified using a stereoscopic microscope and a key for aphid identification by Müller translated into Polish by Achremowicz (1968). To analyse the results the mean number of aphids from 2 dishes was calculated after a logarythmic transformation according to the formula: log (n+1), where 'n' stands for the number of aphids.

Fig. 1. Localization of aphid observation in different regions in Poland

Results

Table 1. presents the time of catches of *A. frangulae* first specimens into yellow dishes in the spring, in decades from the following years: 1970-1979, 1980-1989, 1990-1999 and 2000-2006 in the four monitored sites. In sites located in the north of Poland (Bonin and Szyldak) and in the south (Stare Olesno) aphids tended to appear later and later each season. In Szyldak and Bonin first spring migrants of *A. frangulae* were registered on 3 and 27 June in the 1970-1979 decade respectively, and on 16 June and 3 July in the 1980-1989 decade respectively, and on 11 and 10 July in the 1990-1999 decade respectively. A similar concord took place in Stare Olesno located in the south of Poland. There also the 1970-1979 decade signified the earliest spring migration of *A. frangulae*. The onset of migration was registered on 27 May. In two subsequent decades (1980-1989 and 1990-1999) first aphids were registered at a later time, on 21 June and 3 July respectively. At Jadwisin (central Poland) the first aphids in the 1970-1979 decade were recorded on average on 1 June, hence a few days later than on average in the 1980-1989 decade (27 May) and a few days earlier than on average in the 1990-1999 decade (5 June). The latest time when they were registered was in 2000-2006 (25 June on average). These results, however, cannot be fully comparable with the previous data because of a shorter period of observation.

Fig. 2. illustrates the course of dynamics of *A. frangulae* winged morphs in given years in 1970-2006 in the four sites. The number of aphids in the same site was different in different years. This, at times, high fluctuation among the years was the result of changing weather conditions which is a natural phenomenon in the environment. It seems though that there was a general tendency for aphid number to decrease, and the period when their number was relatively the smallest were years 1992-1994 depending on the site. In 1991 in Bonin and Stare Olesno, and in 1992 also in Szyldak the aphids were not registered at all, similarly as in some earlier and later years. The record number of *A. frangulae* was registered in 1978 in all the sites. In Stare Olesno it reached over 10 000 specimens. The number was less abudant in Jadwisin, and the lowest in Szyldak and Bonin. Similarly high numbers in respective sites had not been registered in the remaining years of research.

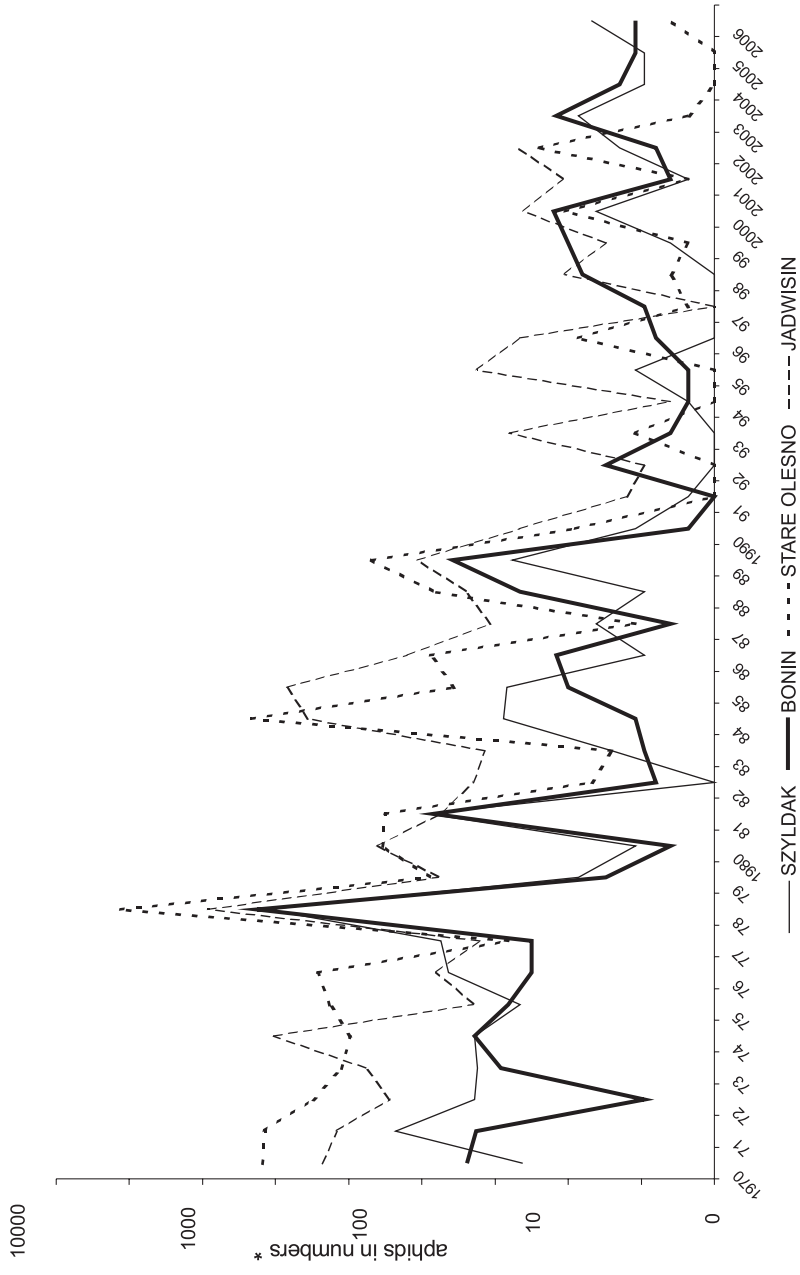

Fig. 2. Number dynamics of winged morphs of *Aphis frangulae* Kalt. in 1970-2006 in 4 sites

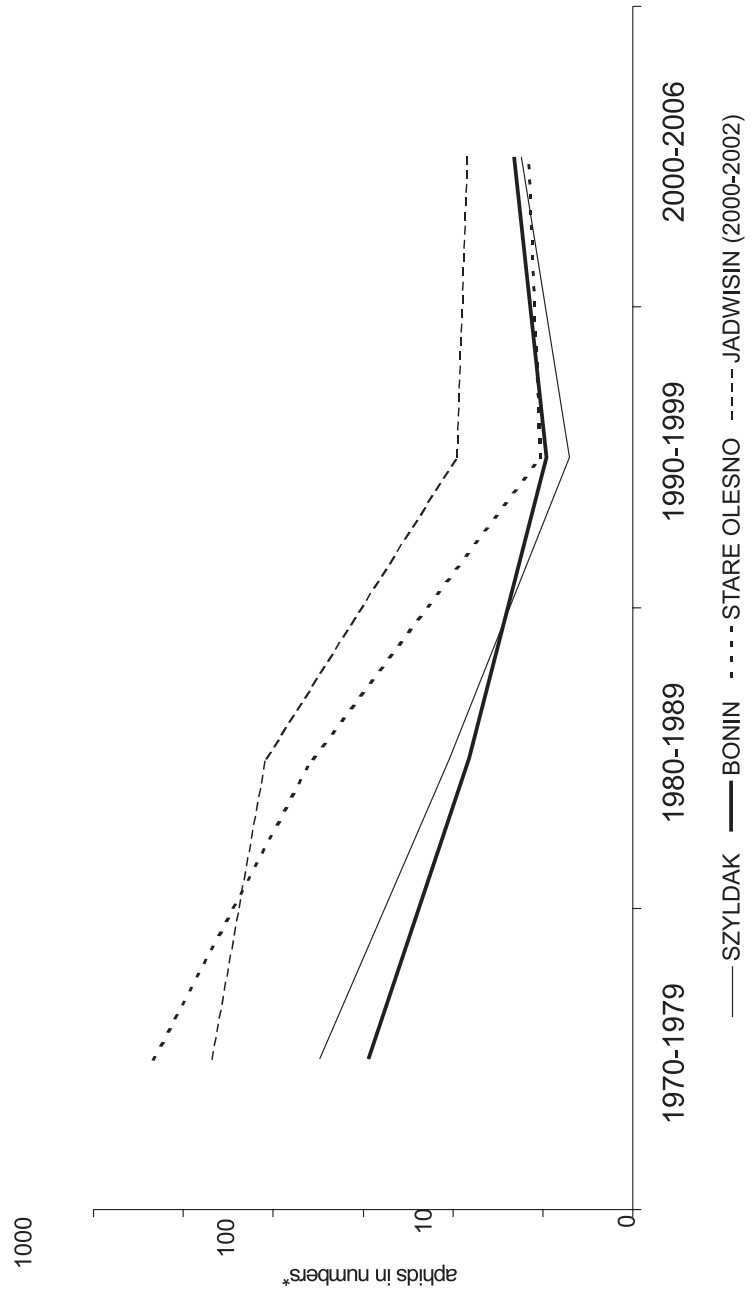

Fig. 3. Number dynamics of winged morphs of *Aphis frangulae* Kalt. in 1970-2006, on average in 1970-1979, 1980-1989, 1990-1999 and 2000-2006 in 4 sites

Table 1. Time of first *Aphis frangulae* Kalt. catches into yellow traps in spring in the decades of 1970-1979, 1980-1989, 1990-1999 and in 2000-2006 in 4 sites

Sites	Years			
	1970-1979	1980-1989	1990-1999	2000-2006
	Date on average			
Szyldak	3. June	16. June	11. July	30. June
Bonin	27. June	3. July	10. July	29. June
Jadwisin*	1. June	27. May	5. June	25. May
Stare Olesno	27. May	21. June	3. July	25. June

*1970-2002

Fig. 3. presents the course of *A. frangulae* number dynamics in 3 decades of 1970-1979, 1980-1989, 1990-1999 and 2000-2006 in the discussed sites. The presentation of average results from a perspective of a decade better illustrates the course of these insect occurrence dynamics across many years. In all those sites the highest number was recorded in the 1970-1979 decade. In two subsequent decades (1980-1989 and 1990-1999) the number gradually decreased and in the decade of 1990-1999 it reached the lowest level, also in all the researched sites. After this period no further decrease in their number was observed, and the average data from the 2000-2006 period showed that there was a slight trend for the number of aphids to increase, especially in three sites (Szyldak, Bonin and Stare Olesno). A lack of a similar trend in Jadwisin may be connected with less data from this particular site related to a shorter period of aphid observation (2000-2002).

Discussion

The number of aphid population depends on ecological and biological factors and, therefore, is different in different sites and years. Only the monitoring of number dynamics that spans across many years enables the determination of importance of these insects in the epidemiology of virus diseases. The changes in pressure of *A. frangulae* that were confirmed, were manifested by a progressing decrease of their number as time passed and testified to a decreasing role of these aphids as vectors of potato viruses, mainly PVY and PVM.

The cause of such changes has not been explained yet. It may be supposed that this phenomenon may be connected with a decreasing land area used for potato crops in Poland that has been taking place for some years now. It is estimated that in 2007 this plant was cropped on the land area of about 0.6 mln ha which was nearly 5 times smaller than the one recorded in 1970 (about 2.7

mln ha). *A. frangulae* is an oligophagous species. Thus it has a limited extent of host plants. The potato, therefore, is an important host plant and it seems logical that such a large decrease of the land area, where it is cropped, may be one of the reasons for which the number of aphid species is declining.

Research results confirmed previous claims that in the north of Poland *A. frangulae* occurd in smaller numbers than in the central and southern Poland (Wisłocka & Kostiw, 1978; Kostiw, 1987; 2004). In Bonin and Szyldak, which are located in the north of Poland the number was much smaller, especially in the first two decades (1970-1979 and 1980-1989) than in Jadwisin (central Poland) and Stare Olesno (southern Poland).

References

Gałecka B. 1978. Wybrane zagadnienia ekologii mszyc występujących na ziemniakach. Zesz. Probl. Post. Nauk Roln. PWN, Warszawa, z. 208, 7-18.

Kostiw M. 1987. Przenoszenie ważniejszych wirusów ziemniaka przez mszyce. Inst. Ziemn. Bonin, 105p.

Kostiw M. 2004. Czynniki sprzyjające i utrudniające produkcję nasienną ziemniaka w Polsce i ich zmiany. Zesz. Probl. Post. Nauk Roln. PWN, Warszawa, z. 500: 147-156.

Müller F.P. 1966. Mszyce trafiające do żółtych szalek. Instytut Ochrony Roślin, Poznań 1968, 31p.

Siemaszko J. 1952. Badania nad mszycami ziemniaczanymi. Rocz. Nauk Roln., Warszawa, 64: 95-135.

Wisłocka M., Kostiw M. 1978. Występowanie mszyc na plantacjach ziemniaka w 7 miejscowościach Polski w latach 1968-1975. Zesz. Probl. Post. Nauk Roln. PWN, Warszawa, z. 208, 147-158.

Występowanie mszycy kruszynowo ziemniaczanej (*Aphis frangulae* Kalt.) w uprawie ziemniaka w latach 1970-2005 i zachodzące zmiany

Streszczenie

Monitoring osobników uskrzydlonych mszycy kruszynowo-ziemniaczanej (*Aphis frangulae* Kalt.) prowadzono metodą żółtych naczyń Moerickego w latach 1970-2006 w 4 miejscowościach położonych w różnych rejonach kraju. Uzyskane wyniki wykazały, że w miarę upływu czasu liczebność tej mszycy zmniejszała się. Najwyższą liczebnością odznaczała się dekada z lat 1970-1979 we wszystkich miejscowościach. W kolejnych 2 dekadach (lata 1980-1989 oraz 1990-1999) obserwowano wyraźnie postępujący spadek liczebności. Wydaje się, że jedną z przyczyn tego zjawiska mógł być zmniejszający się (około 5-krotnie) areał po-

wierzchni uprawy ziemniaków w Polsce w latach 1970-2006. *A. frangulae* jest m. in. wektorem wirusa Y ziemniaka, mającego duże znaczenie gospodarcze w nasiennictwie tej rośliny. Zatem zmniejszenie się jej liczebności może sugerować malejącą rolę tego owada w epidemiologii wirusa Y.