

Incidence of *Apple mosaic virus* (ApMV) on hazelnut in south-east Poland

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ABSTRACT

The investigation of hazelnut infestation with *Apple mosaic virus* (ApMV) was carried out in the years 2001, 2003, and 2004, on *Corylus avellana* L., *C. maxima* Mill., *C. americana* Walt., and *C. colurna* L. trees cultivated in plantations, collections, cottage gardens, allotments, urban greenery, and originating from natural habitat. All together, 532 plants representing 27 cultivars and not specified plant material from amateurish plantation and growing wild, were tested for the presence of ApMV using ELISA test. The presence of ApMV was detected in all tested trees of 'Negret' and in a single tree of clone 104 E. The disease symptoms were noted in affected trees only in the year 2004, characterized by moderate temperatures in May; the symptoms took the form of chlorosis, chlorotic lines and ringspots.

INTRODUCTION

The investigation of hazelnut infestation with *Apple mosaic virus* (ApMV) were conducted mostly in the countries where the plant is cultivated commercially: USA, Spain, Italy. They were studies of applied intention because the virus presence was screened within plantations (Postman and Cameron 1987, Postman and Mehlenbacher 1994, Aramburu and Rovira 2000) or the effect of the virus on yield was assessed (Aramburu and Rovira 1998, Rovira and Aramburu 1998).

During recent years hazelnut production in Poland increased noticeably, which found its reflection in new plantations located in its south-eastern region. Therefore the need to investigate the ApMV presence become apparent also for plants growing in our country; the need particularly urgent if the pollen transmission possibility should be taken into consideration (Cameron and Thompson 1985, Aramburu and Rovira 2000, Rovira and Aramburu 2001).

The survey undertaken at the first phase (Piskornik et al. 2002) was carried out on material growing in the largest collection of hazelnut in Poland in the Experimental Hazelnut Breeding Station in Kraków and revealed the presence of ApMV on trees of two cultivars: 'Negret' and 'Gustav's Zellernuss'. The aim of the second part of the study, the result of which are the subject of present paper, was to examine of a broad range of plant material, both cultivated and growing wild, for the presence of *Apple mosaic virus* ApMV. In addition, the symptom development was described in infected 'Negret' trees.

MATERIAL AND METHODS

The object of the study was hazelnut (*Corylus avellana* L., *C. maxima* Mill., *C. americana* Walt., and *C. colurna* L.) cultivated and originating from natural habitat, mostly in south-eastern Poland. Material tested was derived from plantations and nurseries (Table 1), collections (Table 2), home gardens, allotments, parks and urban greenery and growing wild in natural habitats (Table 3). All together 532 hazelnut trees were tested: 27 varieties in 6 plantation originating from at least 15 nurseries, 2 collections, specimens from 5 parks in 2 localities, small amateurish cottage plantations in 14 localities, 6 allotments in 5 cities and wild growing hazelnuts from surroundings of 4 localities (Fig. 1).

Leaves of the middle part of a current year long shoot from at least four shoots per tree were taken for evaluation since the middle of May till the end of June in the years 2001, 2003, and 2004. Three individuals were selected for evaluation out of the bigger population, for varieties of the same origin. DAS ELISA procedure was applied for tests, using commercial kit containing immunoglobulines and alkaline phosphatase conjugates obtained from Loewe (Germany), in the presence

of positive and negative control, on Cartel plates. Absorbances were measured at 405 nm using Labsystems Multiskan MS Photometer.

The visual inspection of all tested plants was carried out during test period for the presence of any disease symptoms.



Figure 1. Location of specimens. * - plantations, ● - collections, ■ - nurseries, ▲ - urban greeneries, # - amateurish cottage plantations, ■ – allotments, ● - wild growing

RESULTS AND DISCUSSION

The results of ELISA tests conducted revealed the presence of ApMV only in the trees of 'Negret' (on both plantations tested, in material originating from two nurseries) and in clone 104 E – single tree in collection, being the plant material imported from Italy (tables 1 and 2). There was no virus detected within the other tested individuals (tables 1, 2, and 3).

The outcome of the survey confirmed that hazelnut ‘Negret’ occurred to be cultivar infected with ApMV, similarly as in Spain, Italy and USA (Aramburu and Rovira 2000) and belongs to cultivars which can contribute to virus spread. There was also the first report concerning clone E 104 in that respect; up today this clone was not listed among those tested for ApMV presence.

Table 1. Incidence of ApMV in hazelnut plants cultivated in plantations and nurseries revealed by DAS ELISA

	<i>C. avellana/C. maxima</i> Cultivar	Number of plantations	Number of nurseries	Result of ELISA
1.	‘Cosford’	4	6	negative
2.	‘Merville de Bollwiller’ syn. ‘Wonder from Bollwiller’	1	5	negative
3.	‘Garibaldi’	1	1	negative
4.	‘Krótkookrywowy’ syn. ‘Lange Zellernuss’, ‘Longuette’	1	1	negative
5.	‘Nottingham’	1	1	negative
6.	‘Truchsess Zellernuss’	1	1	negative
7.	‘Webb’s Prize Cob’	4	5	negative
8.	‘Catalan’ syn. ‘Catalonische Zellernuss’	4	7	negative
9.	‘Geante de Halle’ syn. ‘Hall’s Giant’	4	4	negative
10.	‘Mogulnus’ syn. ‘Mogul’	1	1	negative
11.	‘Kulisty pełny’	1	1	negative
12.	‘Jeeve’s Long Seedling’	1	1	negative
13.	‘Syrena’	2	2	negative
14.	‘Redleaved’	1	1	negative
15.	‘Early Long’ syn. ‘Lang Tiding Zeller’	1	1	negative
16.	‘Lubelski Groniasty’	1	1	negative
17.	‘Strzepolistna’	1	1	negative
18.	‘Ludolf’s Zellernuss’	1	1	negative
19.	‘Barcelona’	3	3	negative
20.	‘Trapezunter’	4	4	negative
21.	‘Warsaw’s Red’	1	1	negative
22.	‘Negret’	2	2	positive
23.	‘Ennis’	-	1	negative
24.	‘Butler’	-	1	negative
25.	‘Lambert’s Redleaved’	1	2	negative
26.	‘Lambert’s Red’	1	1	negative
27.	‘Lambert’s White’	2	2	negative

Table 2. Incidence of ApMV in hazelnut plants cultivated in collections revealed by DAS ELISA

Species, cultivar, clone	Origin of plant material	Result of ELISA
1. 119	Italy	negative
2. TG L	Italy	negative
3. 123 F	Italy	negative
4. 104 F	Italy	negative
5. G 1	Italy	negative
6. 3 L	Italy	negative
7. 101	Italy	negative
8. 104 E	Italy	positive
9. <i>C. avellana</i> 'Lewis'	USA	negative
10. <i>C. avellana</i> 'Mortarella'	USA	negative
11. <i>C. avellana</i> 'Casina'	USA	negative
12. <i>C. avellana</i> 'Clark'	USA	negative
13. <i>C. avellana</i> 'San Giovanni'	USA	negative
15. <i>C. avellana</i> 'Fusco Rubra'	Poland	negative
14. <i>Corylus americana</i>	Poland	negative
16. <i>Corylus colurna</i> L.	Poland	negative

Table 3. Incidence of ApMV in hazelnut plants cultivated on amateurish cottage plantations, allotments, urban greenery and wild growing revealed by DAS ELISA

Origin of plant material	Number of tested specimens	Result of ELISA
1. Amateurish cottage plantations	97	negative
2. Allotments	33	negative
3. Urban greenery	117	negative
4. Wild growing	64	negative

Visual examination carried out in the years 2001 and 2003 did not reveal any disease symptoms on trees of 'Negret' or clone E 104 that could be ascribed to ApMV infection. However in the year 2004, on 'Negret' in the only plantation under repeated examination, distinct symptoms were noted. They took the form of chlorotic ringspots, mottling, lines, and oak-leaf patterns; sometimes discolorations developed between and/or along veins (Fig. 2). During the first screening (24 of May) the symptoms were less or more diffused (Fig. 2 A and B), with time they became partly masked: during the second survey (21 of June) symptoms on one tree disappeared, on the other two became more conspicuous (Fig. 2 C and D). They were first observed and described symptoms of ApMV infection on hazelnut in Poland, during prior observations (Piskornik et al. 2002) infected trees did not exhibit visible symptoms. The presence of disease symptoms should be attributed to the weather condition in the year 2004, particularly to the course of average and maximum daily temperatures in the spring months (Fig. 3), especially in the first half of May, the period of the rapid leaf development. ApMV, the member of ilarvirus group, is a labile virus, concentration of which can be negatively affected by high temperatures (Matthews 1991, Zotto and Nome 1999), and whose disease symptoms are masked at such temperatures (Aramburu and Rovira 1998).

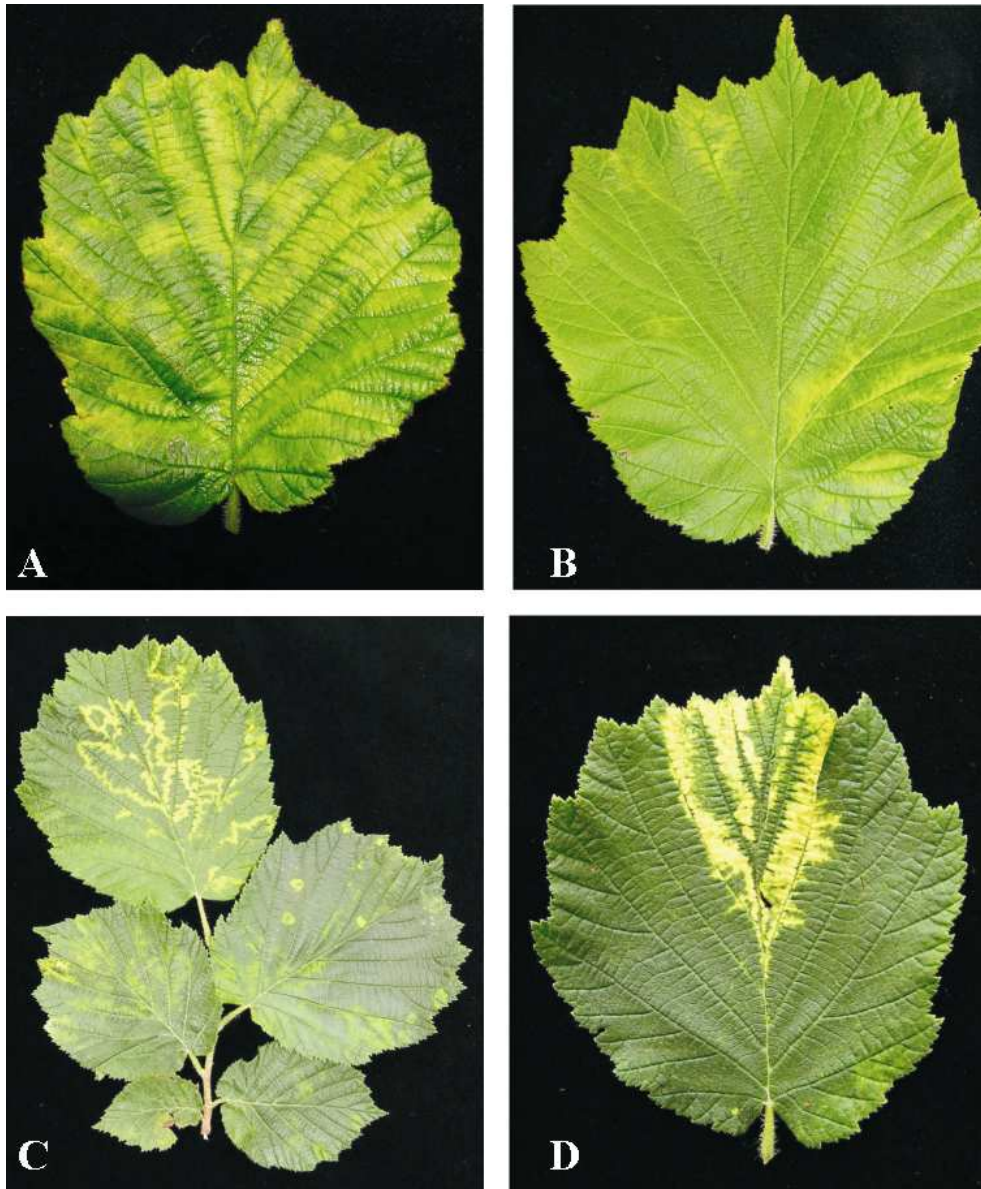


Figure 2. Leaf symptoms on *Corylus avellana* 'Negret' affected with *Apple mosaic virus* observed: A and B on May, 24; C and D on June, 21. A – diffused chlorosis, B – diffused rings and chlorosis along veins, C – line patterns, mottling and ringspots, D – yellowing along veins

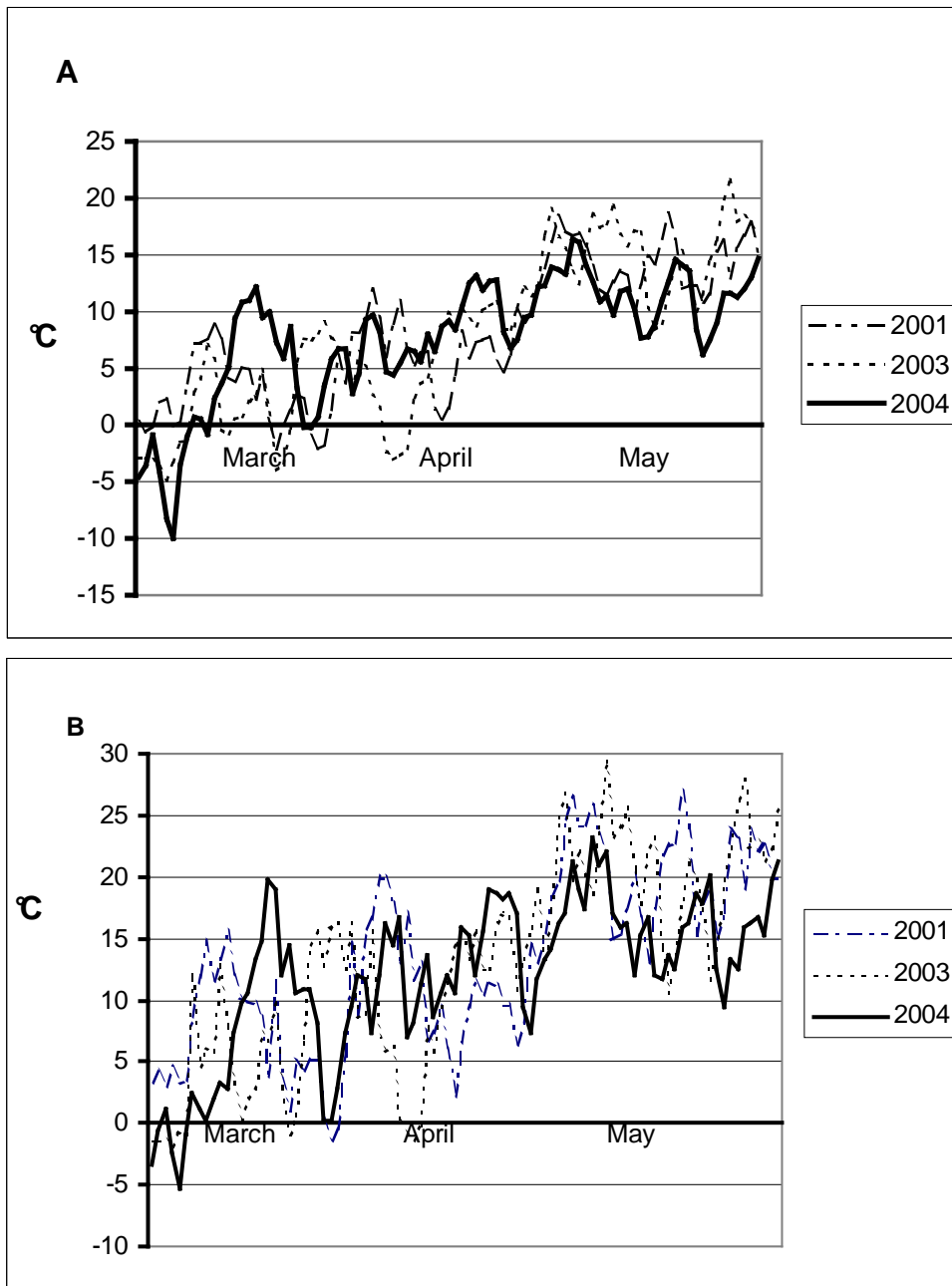


Figure 3. Average (A) and maximum (B) daily temperatures for March, April, and May in the years 2001, 2003, and 2004 in Garlica near Kraków

Taking into consideration lower maximum and average daily temperatures of that period in the year 2004 in comparison to the corresponding periods of years 2001 and 2003, the temperature conditions of the year 2004 can be regarded as the reason of symptoms development. It should be concluded as well, that elimination of hazelnut plants infected with ApMV can not depend upon only visual inspection of symptom development; the serological examination is essential in that case as well.

CONCLUSIONS

1. The presence of *Apple mosaic virus* (ApMV) was confirmed within hazelnut germplasm in Poland only on plant material of foreign origin.
2. 'Negret' was the cultivar contributing to the virus dispersion in Poland.
3. There was no ApMV presence detected within the population of wild growing hazelnut in Poland.

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**WYSTĘPOWANIE WIRUSA MOZAIKI JABŁONI (APMV) NA LESZCZYNIE
W POŁUDNIOWO-WSCHODNIEJ POLSCE**

Streszczenie: Badaniami, mającymi na celu ocenę występowania wirusa mozaiki jabłoni (ApMV) na leszczynie w Polsce południowo-wschodniej, objęto krzewy leszczyny *Corylus avellana* L., *C. maxima* Mill., *C. americana* Walt., *C. colurna* L. rosnące na plantacjach, w kolekcjach, ogródkach przydomowych, ogrodach działkowych, parkach i zieleni miejskiej oraz dziko rosnące w warunkach naturalnych. Z użyciem testu serologicznego ELISA zbadano łącznie 532 krzewy leszczyny reprezentujące 27 odmian oraz nieokreślony materiał z upraw amatorskich i egzemplarze dziko rosnące. Obecność ApMV stwierdzono u wszystkich testowanych krzewów odmiany 'Negret' oraz u pojedynczego krzewu klonu 104 E. Objawy chorobowe na liściach porażonych drzew 'Negret' w postaci chloroz, chlorotycznych linii i pierścieni obserwowano tylko w sezonie wegetacyjnym 2004 roku, charakteryzującym się umiarkowanymi temperaturami w maju.

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