

RESISTANCE OF APPLE CULTIVARS
TO TWO-SPOTTED SPIDER MITE, *TETRANYCHUS*
URTICAE KOCH (ACARINA, TETRANYCHIDAE)
PART II. INFLUENCE OF LEAF PUBESCENCE
OF SELECTED APPLE CULTIVARS ON FECUNDITY
OF TWO-SPOTTED SPIDER MITE

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Abstract: Number of hairs on abaxial leaf surface of 13 apple cultivars differed significantly. The most hairs per 1 cm² on abaxial surface were on cvs. Lodel (2,578.3) and Jonafree (2,462.2). Leaves of cultivars Antonówka and Novamac had the least number of hairs (1,054.4; 1,285.7; respectively). Correlation between number of hairs on abaxial leaf surface of investigated apple cultivars and *Tetranychus urticae* (Koch) female fecundity decreased during 10 first days of their lives. Along with increased number of hairs, the fecundity of this species declined.

Key words: apple varieties, leaf pubescence, fecundity of *Tetranychus urticae* Koch

INTRODUCTION

Correlation between hair density on abaxial leaf surface and population density of *Tetranychus urticae* Koch has been very controversial. Most investigators have proved that abundant leaf pubescence on abaxial leaf surface negatively affects development of European red mite (*Panonychus ulmi* Koch), two-spotted spider mite (*T. urticae* Koch) and carmine spider mite (*T. cinnabarinus* Boisduval) (Stonner and Gentile 1968; Hramcowa 1965; Luczyński et al. 1990; Peters i Berry 1980; Bielak 1979). Also Kamel and Elkassaby (1965) investigating susceptibility of different cotton cultivars to carmine spider mite infestation revealed that this species developed the least on cultivars with high hair density.

Several authors revealed different tendency in correlation between leaf pubescence on lower leaf surface of apples and strawberries and spider mite population (Kishaba et al. 1972; Goonewardene et al. 1976; 1978; Warabieda et al. 1997). They

found that higher number of hairs on the lower surface of apples' and strawberries' leaves positively affected population density of spider mites. However, Paiva and Janick (1980) did not find significant correlation between hair density on leaves of different apple clones and colonization intensity of European red mite.

Most presented surveys referred to a correlation between hair density on the abaxial leaf surface and colonization intensity by different spider mite species. However, as these investigations were carried out in different field conditions, the collected results can not be compared due to different leaf sizes, tree canopy, ages of trees and presence of natural enemies.

The aim of conducted studies was to determine in controlled conditions an influence of hair density on the abaxial leaf surface of selected apple cultivars on two-spotted spider mite fecundity.

MATERIAL AND METHODS

The investigations were performed on two Canadian cultivars (Novamac and Lodel), three French cultivars (Romus, Priam and Florina), two American cultivars (Jonafree and Freedom), two Russian cultivars (Antonówka and Pionier) and three Polish cultivars (Primula, VI-17D₂ and Witos).

Sampling was done in June, July and August during growing season. The sample contained 10 the same age leaves collected from vegetative shoots. Number of hairs per 1 cm² on the abaxial leaf surface was calculated based on a number of hairs on the area of 4 mm².

At the same time the fecundity tests were carried out on leaf disks being at the same age as leaves on which number of hairs was counted and representing investigated cultivar. Fecundity was evaluated during 10 first days of fecundate period. There were additional tests done on fecundity throughout entire life cycle of two-spotted spider life on some cultivars.

The collected data was submitted to an analyses of variance and a Student's t-test.

RESULTS

Leaves of examined apple cultivars differed significantly in the number of hairs on an abaxial surface. Also, significant differences were noted between the number of hairs and a time of taken measurements.

The number of hairs systematically increased from June to August on cvs. Lodel, Antonówka, VI-17-D₂ and Pionier. On cultivars Novamac and Redfree the number of hairs was the highest in June and then decreased by the end of growing season. On cultivars Romus, Lodel, Jonafree, Primula, Freedom, Priam, Florina and Witos the number of hairs was the highest in July and then decreased by the end of growing season (Tab. 1).

Mean calculate for the entire growing season revealed significant differences between particular cultivars. The highest number of hairs on abaxial leaf side per 1 cm² was recorded on cv. Lodel (2,578.3) and Jonafree (2,462.2). Means for cvs. Florian and Redfree were a little lower (2,013.5 and 1,886.6 respectively). The lowest mean values were calculated for cv. Antonówka (1,054.8), cv. Novamac (1,285.7) and Romus (1,437.5) (Tab. 2).

Table 1. Number of hairs on abaxial surface of examined apple cultivars' leaves calculated for 1 cm² and mean fecundity of females of *T. urticae* during 10 first days of their life

Apple cultivars	Number of hairs per 1 cm ²			Mean fecundity of females during 10 first days		
	June	July	August	June	July	August
Novamac	1 507.0 de	1 270.0 ab	1 080.0 a	20.2 f	22.0 f	23.9 abc
Freedom	1 492.5 d	1 657.5 c	1 547.9 de	15.9 e f	13.6 abcd	37.1 d
Lodel	2 205.0 fg	2 597.5 g	2 667.5 g	8.6 abc	10.2 ab	13.2 a
Pionier	1 117.5 b	1 580.0 bc	1 667.5 e	5.5 a	8.8 a	18.6 ab
Primula	1 875.0 ef	1 987.5 ef	1 737.5 ef	11.0 cd	13.2 abcd	19.3 ab
Romus	1 272.5 bc	1 772.5 de	1 272.5 b	10.4 b cd	21.0 ef	31.8 cd
Redfree	2 272.0 g	1 865.0 de	1 522.5 d	14.0 de	14.2 b cde	25.0 bc
Jonafree	2 215.0 g	3 472.5 h	2 455.0 g	16.0 ef	13.4 abcd	24.0 abc
VI-17 D2	1 594.0 e	1 762.5 d	1 862.5 f	5.9 ab	11.2 abc	32.4 cd
Priam	1 525.0 de	1 540.0 b	1 517.5 d	12.3 cde	20.2 def	29.5 bcd
Antonówka	782.5 a	1 072.5 a	1 310.0 c	19.2 f	17.2 b cdef	29.7 bcd
Florina	1 925.0 f	2 125.0 f	1 957.5 fg	14.3 de	14.1 abcde	26.4 bcd
Witos	1 437.0 cd	3 942.5 h	1 112.5 b	8.0 abc	17.8 cdef	25.5 bc

The same letters within columns indicate no differences between cultivars

 Table 2. Mean number of hairs on abaxial surface of examined apple cultivars on 1 cm² and mean fecundity of females of two-spotted spider mite

Apple cultivars	Mean number of hairs on 1 cm ²	Mean number of eggs/female	Mean number eggs /female on life
Primula	1 869.7 de	14.5 abc	28.7 a
Pionier	1 421.7 b	11.0 a	31.5 ab
Lodel	2 578.3 f	11.4 ab	39.9 bc
Novamac	1 285.7 b	22.0 e	61.1 d
Freedom	1 565.8 b cd	22.2 e	51.2 cd
Romus	1 437.5 b	21.1 de	
Jonafree	1 886.6 e	17.7 cde	
Redfree	2 464.2 f	18.1 cde	
VI-17 D2	1 811.6 cde	16.6 bcd	
Priam	1 536.7 bc	21.0 de	
Antonówka	1 054.8 a	22.0 e	
Florina	2 013.5 e	18.3 cde	
Witos	1 749.2 cde	17.1 cde	

Explanation – see table 1

Correlation between the number of hairs on the abaxial side and fecundity of two-spotted spider mite showed decline tendency that means that along with increasing number of hairs the fecundity of two-spotted spider mite decreased (Fig. 1).

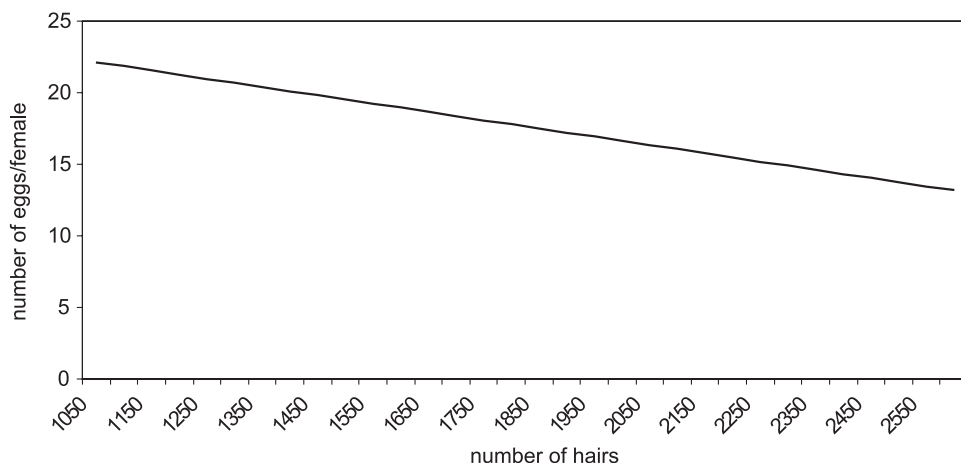


Fig. 1. Correlation between number of hairs and number of eggs per female during 10 first fecundate days

CONCLUSIONS

The analyzed data revealed that the lowest number of hairs was recorded on leaves of cv. Antonówka on which the fecundity of the two-spotted spider mite was moderate. Low number of hairs was also found on cv. Novamac however, the fecundity was the highest on this cultivar. Moderate number of hairs was found on cvs. Freedom and Pionier. The fecundity of two-spotted spider mite was high on cv. Freedom while on cv. Pionier low. The highest number of hairs was recorded on cvs. Lodel, Jonafree and Florian. The fecundity on cv. Lodel was low. Statistical analysis proved a negative correlation between increasing number of hairs on abaxial surface of apple leaves and fecundity of two-spotted spider mite. The conclusion that low number of hairs on abaxial surface of leaves affects fecundity of two-spotted spider mite concurs with the results of Stonner and Gentile (1968), Hramcova (1965), Luczynski (1990), Peters and Berry (1980) and Bielak (1979) referring to European red mite, two-spotted spider mite and carmine spider mite. Kamel and Elkassaby (1965) investigating susceptibility of different cotton cultivars to two-spotted spider mite infestation indicated that this spider mite developed the worst on cultivars with high number of hairs.

The results collected from laboratory studies on correlation between number of hairs on abaxial surface and fecundity of two-spotted spider mite differed from the results obtained by Kishaba et al. (1972), Goonewardene et al. (1976; 1978; 1980), Warabieda et al. (1997) and Warabieda (2000). They proved that higher number of hairs on abaxial surface of apples' and strawberries' leaves affects positively two-spotted spider mite colonization. The laboratory results on fecundity of two-spotted spider mite on cvs. Novamac and Lodel are also different from field results collected by Warabieda (2000). This author found the highest population of *T. urticae* on cv. Lodel and moderate on cv. Novamac. Apple canopy and size of leaf

area might be the reasons of differences as cv. Lodel's leaves were significantly smaller than Novamac's leaves. Hence, smaller area for colonization of two-spotted spider mite could decrease its density on this cultivar.

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POLISH SUMMARY

ODPORNOŚĆ ODMIAN JABŁONI NA PRZĘDZIORKA

CHMIELOWCA, *TETRANYCHUS URTICAE* KOCH (ACARINA, *TETRANYCHIDAE*)

CZĘŚĆ II. WPŁYW OMSZENIA LIŚCI WYBRANYCH ODMIAN JABŁONI NA PŁODNOŚĆ PRZĘDZIORKA CHMIELOWCA

W wyniku przeprowadzonych obserwacji stwierdzono, że liście badanych odmian jabłoni różniły się istotnie między sobą liczbą włosków występujących po dolnej stronie. Najwięcej włosków na 1 cm² dolnej powierzchni liścia stwierdzono u odmian Lodel (2 578,3) oraz Jonafree (2 462,2). Nieco mniej włosków było u odmian Florina (2 013,5) i Redfree (1 886,6). Najmniej natomiast włosków posiadała Antonówka (1 054,8) oraz odmiany Novamac (1 285,7) i Romus (1 437,5).

Wykazano również istotne różnice między liczbą włosków, a terminami przeprowadzonych obserwacji. Na niektórych odmianach, w czasie sezonu wegetacyjnego, liczba włosków systematycznie wzrastała (Lodel, Antonówka, VI-17 D₂, Pionier).

Natomiast na innych odmianach, takich jak Novamac i Redfree, liczba włosków na dolnej stronie liści była najwyższa w czerwcu i do końca sezonu ulegała systematycznemu zmniejszeniu.

Korelacja między liczbą włosków na dolnej stronie liści badanych odmian jabłoni, a płodnością samic przędziorka chmielowa wykazała tendencje spadkową, czyli wraz ze wzrostem liczby włosków obniżała się płodność tego gatunku roztocza.