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Scientific review

Resistance of different apple varieties to European red spider mite (*Panonychus ulmi* Koch)

Otpornost različitih kultivara jabuka na crvenog voćnog pauka (*Panonychus ulmi* Koch)

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ABSTRACT

European red mite (*Panonychus ulmi* Koch) is one of the most common apple pests. Weather conditions, as well as pesticides, affect red mite development. This mite also shows preferences to particular apple varieties. This research was conducted in Zadar County (Croatia) during three years (2016 - 2018) using the winter control of branches method. In 2016 the highest average number of overwintering eggs was found on Gala (338.33), Cripps Pink (241.33) and Red Elstar (247) while on Golden Delicious and Summer Red lower number was observed. In 2017 the highest number was noticed on Cripps Pink (40) and Golden Delicious (24) but still low compared with the previous year. In 2018 the highest number of overwintering eggs was found on Granny Smith (20). Number of overwintering eggs on Golden Delicious and Summer Red was similar in 2016, 2017 and 2018. During this research, no one variety showed a critical number of overwintering eggs.

Key words: apple, European red mite, overwintering eggs, varieties

SAŽETAK

Crveni voćni pauk (*Panonychus ulmi* Koch) je jedan od najznačajnijih štetnika jabuke. Na razvoj crvenog pauka utječu vremenski uvjeti kao i kemijska sredstva za zaštitu bilja. Ovaj štetnik također preferira pojedine kultivare jabuka. Istraživanje je provedeno metodom zimskog pregleda grana na području Zadarske županije (Hrvatska) tijekom tri godine (2016. – 2018.). U 2016. najveći prosječan broj prezimljujućih jaja je pronađen na sortama Gala (338,33), Cripps Pink (241,33) i Red Elstar (247) dok je na sortama Golden Delicious i Summer Red uočeno znatno manje jaja. Tijekom 2017. najveća brojnost je uočena na sortama Cripps Pink (40) i Golden Delicious (24) ali još uvijek niska u odnosu na prethodnu godinu. U 2018. najveći broj prezimljujućih jaja pronađen je na sorti Granny Smith (20). Broj jaja na sortama Golden Delicious i Summer Red je bio podjednak tijekom 2016., 2017. i 2018. Tijekom istraživanja niti na jednom kultivaru nije uočen kritičan broj prezimljujućih jaja.

Ključne riječi: crveni voćni pauk, jabuka, kultivari, prezimljujuća jaja

INTRODUCTION

European red mite (*Panonychus ulmi* Koch) is one of the most important apple pests. It feeds on apple leaves causing problems due to reduction of the photosynthetic activity (Maula and Ali Khan, 2016). According to data of Broufas and Koevos (2000) red mite overwinters as winter egg. Females lay eggs in late summer and early autumn usually on two years old branches, particularly around the buds (Ciglar, 1998). Nymphs hatch from overwintering eggs in early spring and move to young leafs. Groonewardene et al. (1976) found that chemical components of apple leaf affect the abundance of red mite. Cutright (1963) and MacPhee (1961) noticed that climatic factors in particular temperatures also influence red mite development. Higher temperatures force eggs hatching. For example a required period for 50% hatch at 8 °C is 44.8 days while at 20 °C it takes 8.8 days (Herbert and McRae, 1982). Threshold temperatures for egg development vary from 5.5 to 7 °C (Cranham, 1972). According to Putman (1970) threshold temperatures for deposition of viable eggs range from 10.7 °C to 11.7 °C. European red mite also shows preference to particular apple varieties such as Golden Delicious and Gala (Monetti and Fernandez, 1996; Barić et al., 2015). A High number of overwintering eggs was found on Golden Delicious (Barić et al., 2015). According to Hrnčić (1995), susceptible varieties are Golden Delicious and Granny Smith. Moreover, chemical fungicides affected a population of red mites. Barić and Ciglar (1992) found a stimulating effect of some fungicides on overwintering eggs. The main goal of this research was to determine the abundance of overwintering eggs on different apple varieties.

MATERIAL AND METHODS

Study site

The research on two spotted red mite populations was conducted in ten years old apple orchard (6,5 ha) in Ravni kotari (Zadar County) during three years (2016 - 2018). The orchard is located near Suhovare (44°09'30"N 15°26'05"E). The area belongs to the Mediterranean climate (Csa type) characterized by dry and hot summers and wet winters. In the orchard, six varieties were presented: Red Elstar, Summer Red, Granny Smith, Golden Delicious, Gala and Cripps Pink. In the orchard cover crops were presented. Spaces between rows were mowed during the growing period and inter-row herbicide was used. Pest control were measures are based on the principles of integrated production. All apple cultivars were under the same conditions durring the study period.

Sampling method

Samples were taken during the winter period (January-February) and transferred to the laboratory of the Department of Ecology, Agronomy and Aquaculture. For one sample three representative trees were chosen. Each sample consisting of 10 two years old branches 20 cm long (in total 2 m) was examined under the stereomicroscope (Wildbolz, 1962). A total of three samples was taken for each variety. Eggs were counted and the result was presented as a number of overwintering eggs at 2 m lenght.

Data analysis

To calculate differences among samples One Way ANOVA was performed, followed by Tukey' s post hoc test. Statistical analysis was done using the SigmaPlot 11 statistical package (Systat Software).

RESULTS AND DISCUSSION

During this research 54 samples in total were examined. The highest average number of winter eggs in 2016 was recorded on Gala (338,33), unlike Golden Delicious (28.66) where the lowest number was found. There was a significant difference (One Way ANOVA, df=5, F=6,579*,* $p<0,001$) between Gala and Golden delicious as well as between Gala and Summer Red (Figure 1). Barić et al. (2015) who also found a high number of overwintering eggs on Gala as well as on Golden delicious showed similar results. Though in this research number of overwintering eggs on Gala was twenty times greater than on Golden Delicious. According to Pajač Živković and Bardić (2017) in their research Golden Delicious showed the lowest number of overwintering eggs. Some authors (Monetti and Fernandez, 1996; Hogmire and Miller, 2005) also indicated Gala as particularly susceptible apple variety. Ciglar (1998) noted that a critical number of overwintering eggs vary from 800 to 1000 at 2 m lenght. However, according to this data no one variety showed a critical number of overwintering eggs. No significant differences were found between varieties in 2017. Cripps Pink (40) showed the highest average number. However, compared with the previous year it was still very low (Figure 2). The lowest number was recorded on Summer Red and Red Elstar. One of the possible reasons for such results might be lower temperatures during the winter period (Figure 3). According to data by Jeppson et al. (1975), low winter temperatures can reduce the population of red mites. Threshold temperatures for deposition of viable eggs vary between 10.7 °C and 11.7 °C (Putman, 1970). Critical

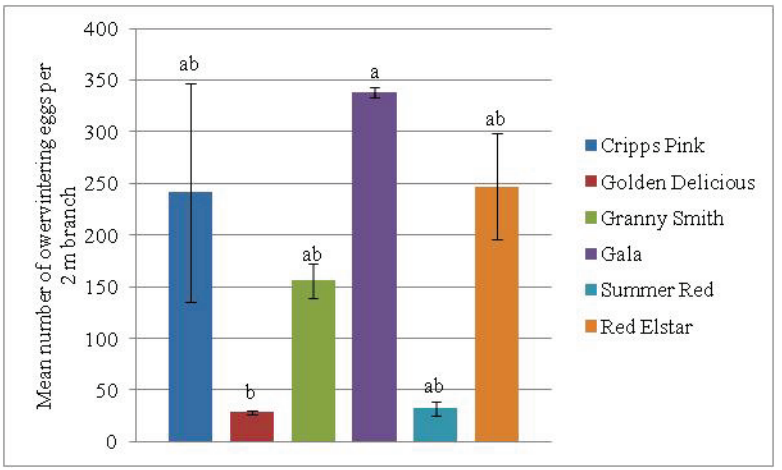

Figure 1. Mean number of overwintering eggs of European red mite on apple in 2016. Different letters means significant differences (Tukey's test, p<*0,05*)

Slika 1. Prosječan broj zimskih jaja crvenog voćnog pauka u 2016. Različita slova označavaju statistički značajnu razliku (Tukey test, p<*0,05*)

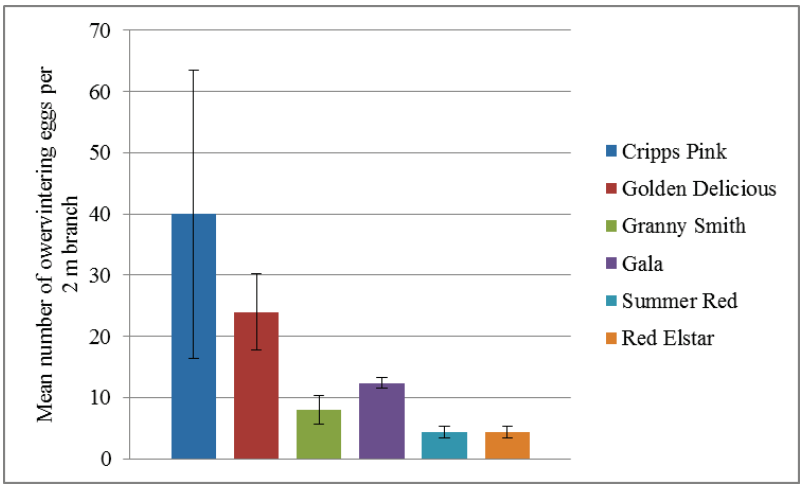

Figure 2. Mean number of overwinntering eggs of European red mite on apple in 2017.

Slika 2. Prosječan broj zimskih jaja crvenog voćnog pauka u 2017.

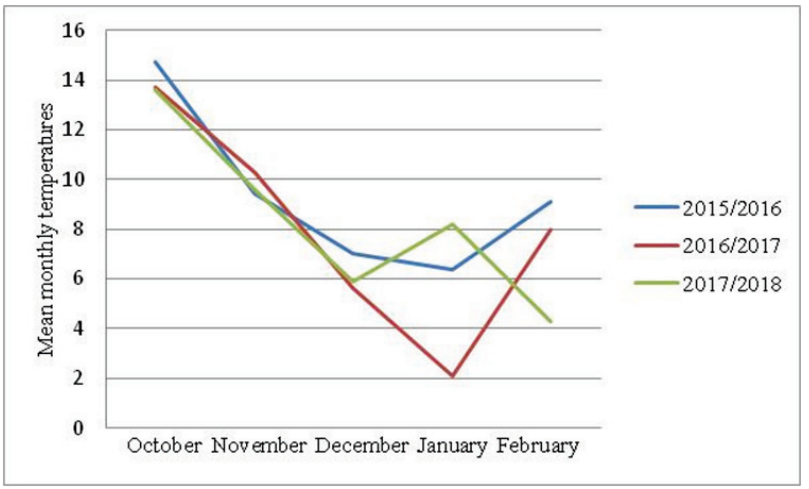

Figure 3. Mean monthly temperatures durring the study period (2016 - 2018)

Slika 3. Srednje mjesečne temperature tijekom perioda istraživanja (2016. – 2018.)

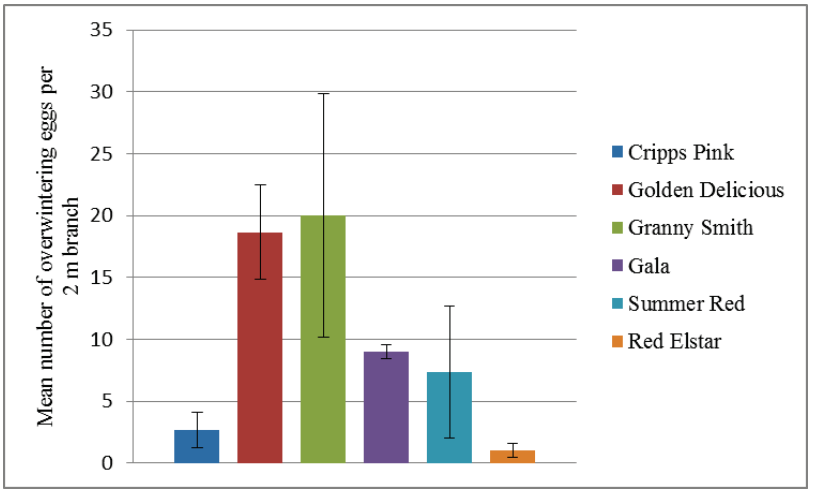

Figure 4. Mean number of overwinntering eggs of European red mite on apple in 2018.

Slika 4. Prosječan broj zimskih jaja crvenog voćnog pauka u 2018.

temperatures for egg development range between 7.2 °C and 6.3 °C, but for postovarial development they vary between 9.2 °C and 11.7 °C. Cutright (1963) noticed that overwintering eggs deposition usually starts in mid-August and finishes in November, but the most intensive oviposition starts in October. In October 2016 there were six days with temperatures below the critical values. In November the same year as many as fifteen days with critical temperatures were registered. The lowest temperature (- 4,1 °C) was observed in January. Thus lower temperatures during the winter period might affect the threshold in the development of red mites. These results clearly showed differences in overwintering eggs abundance in three seasons. It is not entirely clear why almost all apple varieties showed a lower number of overwintering eggs in 2017 compared to the previous year. One possible reason was the temperature values during the period of oviposition as well as during the winter period (Figure 3). Obviously, lower winter temperatures can affect eggs development and cause their destruction. In 2018 the highest values were showed by Granny Smith (20) and Golden Delicious (18.66) but still under the critical number (Figure 4). Statistically significant difference between varieties was not found. Though weather conditions during 2018 were favorable for red spider development their population was surprisingly low. Mean temperatures ranged between 26.4 °C in August and 9.6 °C in November. We could conclude that in this research only Golden Delicious and Summer Red showed the constant number of overwintering eggs during three years, while all other varieties varied between the seasons. More research is needed to effectively asses the influence of apple varieties on red mite population. Moreover, future research should focus on mobile stages of this pest during the period of vegetation using a mechanical knockdown method or visual inspection of leaves.

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