A FAUNISTIC STUDY ON MITES (Acari) ON CITRUS FRUITS IN CROATIA IN 2018

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ABSTRACT

Mites (Acari) are economic pests of citrus crops. Most important citrus mites belong to families Tetranychidae, Tenuipalpidae, Tarsonemidae and Eriophydae. The goal of this study was to make a list of citrus mites in Croatia using the scientific literature and to carry out a faunistic research to show their distribution and to make a checklist of all citrus mites in Croatia. Literature search showed that eight species of citrus mites are present in Croatia. Faunistic research was concluded in 2018., in six counties containing 90 sites and 90 samples using visual inspections and mite sampling with detailed information on localities. Samples were collected from 5 different host plants from family Rutaceae. Collected samples were identified to the species level on the basis of morphological characters of adult mites, using classical identification method according to relevant morphological keys. Mites identified in faunistic research belong to 5 families: Tetranychidae, Phytoseiidae, Tydeidae, Cunaxidae and Trombidiidae. *Panonychus citri* was the most frequent plant-feeding species found and was determined in 19 samples. Family Tydeidae showed as the most frequent in total, determined in 40 samples. The most common predatory mite was *Euseius stipulatus* (Athias-Henriot) confirmed in 15 samples. *E. stipulatus* is reported as a new species for Croatian mite fauna along with the species from families Cunaxidae and Trombidiidae. Checklist of mite fauna on citrus fruits in Croatia contains 11 determined species and 7 families.

Key words: mites, citrus plants, fauna, checklist, Croatia

1 INTRODUCTION

Mites (Acari) are economic pests of citrus plants. It is estimated there are between 500 000 and 1,000,000 species of mites worldwide. Phytophagous and predatory mites are most important to agriculture (Petanović, 2004). Harmful species of mites belong to families Tetranychidae, Tenuipalpidae and Tarsonemidae and superfamily

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Eriophyoidea. In tetranychoid mites, the feeding symptoms derive from the removal of the contents of cells of palisade tissue involving the disappearance of chloroplasts and the clotting of cellular residues, these taking on the appearance of small, amber-coloured masses (Vacante 2010). Citrus plants belong in family *Rutaceae*. The harvested area of citrus extends from 40° parallel north to 40° south (Vacante, 2010). It has been calculated that about 140 countries grow citrus and the FAO estimated a total harvested area of over 10,000,000 ha for 2017 (FAOSTAT, 2017). The objective of citrus production is to harvest a large crop of quality fruit (Zalom *et al*. 1991). Optimal production can be achieved only with healthy trees. An even more important aspect of integrated pest management is evaluation of pest control methods for their impact on the total orchard system as well as for their effectiveness in eliminating the primary pest problem (Zalom *et al*. 1991). The production of citrus fruits worldwide is in relative rise (FAOSTAT, 2017). In Croatia most of the citrus fruit harvested area resides in Dubrovacko-neretvanska county. *Citrus reticulata* is the dominant citrus fruit species in Croatia. According to public statistic data, total area under *Citrus reticulata* in 2017. was 2,100 ha. The increased intensity of international trade of plant material and citrus fruits resulted in new species of economic pests being introduced to Croatia, including mites. In Croatia there were no systemic faunistic research of mites so far. As a result, there is no checklist of mites present in Croatia on citrus fruits. The goal of this study was to make a list of citrus mites in Croatia using the scientific literature and to carry out a faunistic research to show their distribution and to make a checklist of all citrus mites in Croatia.

Checklist made by this research will greatly contribute to the successful mite management as well as prevent their spreading, which is directly related to the preservation of the yield.

2 MATERIALS AND METHODS

Conducted faunistic research included: collecting plant material, sample processing under microscope, saving the samples, mounting slides of samples, determination and identification, marking the sites of faunistic research by GPS coordinates (HRTS96/TM), description of mites with economic importance as well as the most distributed species determined in the researched fauna.

Faunistic research was carried out during the 2018. and covered all coastal counties of Croatia. 6 counties in this research: Istarska, Primorsko-goranska, Zadarska, Sibensko-kninska, Splitsko-dalmatinska and Dubrovacko-neretvanska totaled a number of 90 different sites. As most of the citrus fruit production is located in Dubrovacko-neretvanska county, most of the sites as well as most plant samples are from the aforementioned county. A total of 100 plant samples were taken during this research.

Plant samples were collected in orchards, gardens, garden centers and yards. Plant hosts of sampled mites were: *Citrus reticulata*, C. *sinensis*, C.*s limun*, *C. x paradisi*, C. *grandis*. *C. reticulata* contains 56 samples (62.2 %), *C. limon* contains 18 samples (20%), *C. aurantium* 3 samples (3.3 %), *C. x paradisi* and *C. grandis* contained 1 sample each (1.1%). 9 samples (10%) contained more than one citrus plant so they were marked as *Citrus* spp. The microscopic examination of the mites by optical phase contrast and interference system demands the specimens be cleared and mounted on

slides (Vacante, 2010). Permanent mounts require the use of a slide, some drop of medium and a coverslip of different size and shape, depending on the various species and groups of mites. The used media was Hoyer's medium. Hoyer's medium is widely used and basically derives from Berlese fluid, based on the use of arabic gum and chloral hydrate, and can be used for clear, weakly sclerotized specimens; it also has good optical properties (Krantz and Walter, 2009). The identification of the mites is based on the morphological characteristics of adult mite species. Identification keys were used from following authors: Smith Meyer (1987); Dobrivojevic and Petanovic (1982); Krantz and Walter (2009); Vacante (2010); Hoy (2011); EPPO (2018).
In the process of the identification OLYMPUS BX 51 optical microscope was used (4x, 10x, 20x, 40x and 100x magnification)

3 RESULTS AND DISCUSSION

Faunistic investigation of the mites of citrus plants in Croatia have resulted in 7 identified mite species, as well as 5 families: Tetranychidae, Phytoseidae, Cunaxidae, Trombidiidae and Tydeidae (Table 1).
Quantitative distribution of mites appearing frequency on citrus plants in Croatia is shown in Figure 1 and showed that family Tydeidae and *Panonychus* citri (Tetranychidae) had the highest appearing frequency.
Based on the literature and faunistic data, a checklist of mites on citrus plants in Croatia was made (Table 2). This checklist represents the first list of complete mite species distributed on citrus plants in Croatia.

Table 1: Determined mites in faunistic research on citrus plants in Croatia in 2018.

Phytophagous mites					
Species	Number	Plant Host	Counties	Number of localities	Date of sampling
Panonychus citri	20	*Citrus grandis Citrus limon, Citrus reticulata, Citrus* spp.	Istarska, Zadarska, Sibensko-kninska, Splitsko-dalmatinska, Dubrovacko-neretvanska	24 localities	May – July 2018.
Panonychus ulmi	1				
Tetranychus urticae	2				
Tetranychus turkestani	1				
Predatory mites					
Euseius finlandicus	4	*Citrus aurantium*, *Citrus limon*, *Citrus reticulata*, *Citrus* spp.,	Zadarska, Sibensko-kninska, Splitsko-dalmatinska, Dubrovacko-neretvanska	26 localities	May – July 2018.
Euseius stipulatus	15				
Typhlodromus rhenanus	1				
Family Trombidiidae	1				
Family Cunaxidae	1				
Species of family Phytoseidae	4				

Family Tydeidae					
Tydeidae	40	*Citrus aurantium*, *Citrus reticulata*, *Citrus limon*, *Citrus spp.*, *Citrus x paradisi*,	Istarska, Zadarska, Sibensko-kninska, Splitsko-dalmatinska, Dubrovacko-neretvanska	40 localities	May – July 2018.

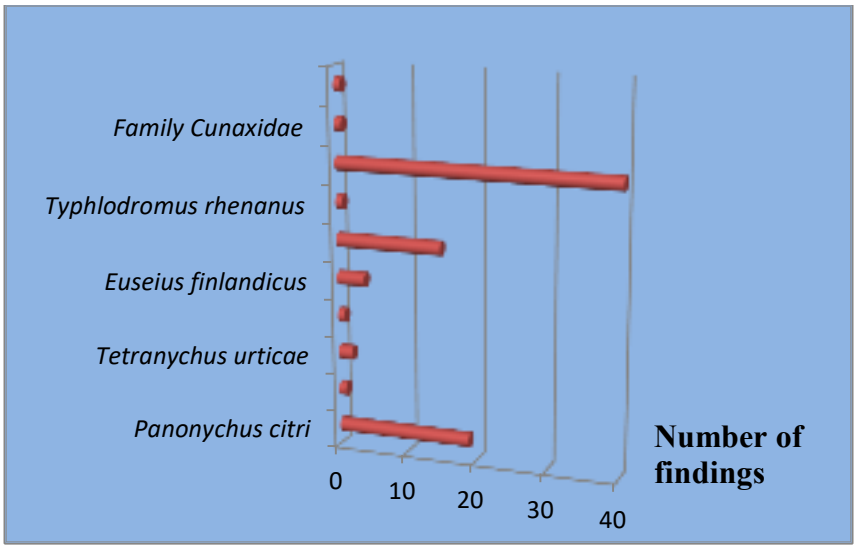

Figure 1: Quantitative distribution of mites appearing frequency on citrus plants.

Table 2: Checklist of mites on citrus plants in Croatia.

Family Tetranychidae
Panonychus citri McGregor 1916
Panonychus ulmi Koch 1836
Tetranychus urticae Koch 1836
Tetranychus turkestani Ugarov i Nikolski
Family Tenuipalpidae
Brevipalpus lewisi McGregor 1949
Brevipalpus obovatus Donnadieu 1875

Family Eriophyidae
Aceria sheldoni Ewing 1937
Aculops pelekassi Keifer 1959
Family Tydeidae
Family Phytoseiidae
Euseius finlandicus Oudemans, 1915
Euseius stipulatus Athias-Henriot, 1960
Thyphlodromus rhenanus Oudemans, 1905
Family Cunaxidae
Family Trombidiidae

4 CONCLUSIONS

During a 2018, inspection on mites on citrus plants (Rutaceae) in the open field, and on house and greenhouse pot plants in Croatia showed that citrus plants host a great variety of phytophagous, predatory mites and family Tydeidae that had the highest appearing frequency. Global trade is one of the major factors in the spread of mites worldwide. Faunistic research resulted in 7 different species of mites, namely: *Panonychus citri, P. ulmi*, *Tetranychus urticae, T. turkestani, Euseius finlandicus, E. stipulatus, Typhlodromus rhenanus* as well as 5 families: Tetranychidae, Phytoseidae, Trombidiidae, Cunaxidae, Tydeidae.
Checklist of all mites on citrus plants in Croatia contains 11 species and 7 families. *E.stipulatus* and species from family Cunaxidae and Trombidiidae are new for Croatia mite fauna.

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