*Persian J. Acarol., 2020, Vol. 9, No. 4, pp. 367–376.*
http://dx.doi.org/10.22073/pja.v9i4.60939
Journal homepage: http://www.biotaxa.org/pja

**Article**

# Specifics of life cycle and damage of *Oligonychus ununguis* (Acari: Tetranychidae) on introduced species of coniferous plants in conditions of megalopolis

**Lesia M. Bondareva[1*], Olga V. Zhovnerchuk[2], Leonid A. Kolodochka[2], Petro Ya. Chumak[3] and Oksana V. Zavadska[1]**

1. *Department of Integrated Protection and Plant Quarantine, Faculty of Plant Protection, Biotechnology and Ecology, National University of Life and Environmental Sciences, Kyiv, Ukraine; E-mails: lnubip69@gmail.com, zavadska3@gmail.com*
2. *Department of Acarology, I.I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine, Kyiv, Ukraine; E-mails: olya@izan.kiev.ua, leon@izan.kiev.ua*
3. *Department of Plant Protection and Quarantine, Agronomy Faculty, Polissia National University, Zhytomyr, Ukraine; E-mail: Chumakp@i.ua*

[*] Corresponding author

**ABSTRACT**
Population of the spider mite *Oligonychus ununguis* (Jacobi, 1905) was monitored on introduced species of coniferous plants in the Fomin Botanical Garden, Kyiv, Ukraine in 2012–2019. The mite material was collected by shaking method, fixed, mounted on slides and then processed according to standard techniques. Severity of damage (R, %) was calculated. Eight varieties of the introduced genera *Pseudotsuga* and *Picea* of coniferous plants were chosen as study objects. The pest was found on *Pseudotsuga* plants for the first time. It was revealed that different species and varieties of conifers differ in attractiveness as host plants for this pest species. The mite *O. ununguis* was the most numerous on plants of *Pseudotsuga menziesii*, *Ps. menziesii* var. *viridis* Franco, and *Picea glauca* (Moench.) Vossf. «Conica». The dependence of shoot growth parameters on pest density is strong according to the value of the coefficient of determination, $R^2$ = 0.8781. The populations of spruce spider mites mostly increase in spring and autumn in Kyiv. In summer, the increase of air temperatures about 30–32 °C slowed the mite development, suppressing its density and the levels of damage on the conifers. Two species of Phytoseiidae, *Typhlodromus laurae* and *Amblydromella inopinata* and their activity in colonies of the pests on plants were observed in 2019. These predaceous mites can colonize the investigated coniferous plants together and control the *O. ununguis* population.

**KEY WORDS:** Hydrothermal coefficient; *Picea*; *Pseudotsuga*; tetranychid mites; Ukraine.

**PAPER INFO.:** Received: 14 July 2020, Accepted: 12 August 2020, Published: 15 October 2020

## INTRODUCTION

The spruce spider mite, *Oligonychus ununguis* Jacobi, 1905, is an incredibly dangerous and very common pest of coniferous plants (Livschitz and Mitrofanov 1973; Gutierrez and Schicha, 1983; Fenilli and Flechtman, 1990; Loyttyniemi and Hellov, 1991; Sun *et al*. 1995; Richmond and Shetlar

**How to cite:** Bondareva, L., Zhovnerchuk, O.V., Kolodochka, L.A., Chumak, P. Ya. & Zavadska, O.V. (2020) Specifics of life cycle and damage of *Oligonychus ununguis* (Acari: Tetranychidae) on introduced species of coniferous plants in conditions of megalopolis. *Persian Journal of Acarology*, 9(4): 367–376.

1996; Yuksel and Ulusoy 2000; Lehman 2002; Akimov and Zhovnerchuk 2010; Zavodchikova and Zavodchikova 2011). It has been reported on more than 100 species of host plants from 44 countries (Migeon *et al*. 2011). The abundance of this pest varies in a wide range, and the pest populations can rapidly grow, as is the general trend for tetranychid mites. The fast reproduction of *O. ununguis* swiftly causes notable damage and browning of plant needles. The shoots of colonized plants become shortened, and then the needles fall off prematurely. The trees weaken and grow more slowly under the cover of the finest webs. The decorative value of such trees is markedly low. Intense pest infestations can weaken the coniferous trees to the point of death in various plantings, including greeneries and industrial plantations. The negative effect of tetranychid mites on plants also causes a decrease in their resistance to climatic factors, diseases and other pests (Bondareva and Chumak 2018).

Controlling the pests of coniferous plants in this case requires such data as the emergence time of first generation and the threshold values of temperature and humidity at which the pest life cycle is completed (Puchalska and Czajkowska 2016). Because of their wide distribution and significant damage, *O. ununguis* mites frequently are the objects of these studies. However, differences in the mite development were found in different parts of the pest range, possibly owing to the local adaptations of mites. When developing the pest control measures, it is necessary to know and take into account the timing and pace of its development in a particular region.

In Ukraine, *O. ununguis* has been found in Polissia (Voitenko 1969), forest-and-steppe zones (Dmitriev 1969; Akimov and Zhovnerchuk 2010; Zhovnerchuk 2013), Carpathians (Zhovnerchuk *et al.* 2019), and Crimea (Mitrofanov *et al.* 1987). There have been reports of findings *O. ununguis* in parks and botanical gardens of Kyiv city on plants of *Picea pungens*, *P. abies*, *P. glauca*, *Pinus sylvestris*, *Juniperus sabina* and *J. turkestanica* (Akimov and Zhovnerchuk 2010). Considering that *O. ununguis* can be a dangerous phytophagous pest of plants grown under the most unfavorable conditions of anthropogenic pressure, the specifics of the mite habitat, development and harmful capabilities in a megalopolis city (such as Kyiv) were chosen as a study object. Fomin Botanical Garden (FBG) was chosen as the study area because of its concentrated diversity of coniferous species in the extensive collection of introduced conifers. Also, FBG is located in the center of Kyiv, prompting the formation of a specific microclimate with sharp fluctuations of temperature and humidity under the increased air pollution. The aim of present study was to study the ecological and biological specifics of the life cycle and harmfulness of *O. ununguis* mite, host plant preferences, and to crudely assess the ability of the natural agents to limit the pest density in the conditions of a megalopolis.

## MATERIALS AND METHODS

During the growing seasons of 2012–2019, in Fomin Botanical Garden, Taras Shevchenko National University of Kyiv, we studied the host preferences of *O. ununguis* on the introduced plants of the family Pinaceae of genera *Picea* A. Dietr., and *Pseudotsuga* Carr. The species composition of phytoseiid mites on various plants were studied here in 2005–2007 (Kolodochka and Omery 2011), and their activity in colonies of the pests on plants of the genera *Pseudotsuga* and *Picea* in 2019.

The mites were collected from plants by shaking the branches on black paper, and transferring with a dissecting needle to 70% ethanol for fixation and storage until they were mounted on microscope slides in Hoyer's medium.

Mite emergence after hibernation and population fluctuations were also assessed regularly (Livschitz *et al.* 2011). The number of generations was calculated based on the analysis of the dynamics of population development, by comparing the seasonally fluctuating ratios of pre-adult and adult stages.

The infestation rates of *Pseudotsuga* and *Picea* plants by *O. ununguis* were determined by calculating the average number of specimens per 100 leaf needles, taken from 30 shoots in average of plants of each variety.

Severity of damage (R, %) was calculated as follows (Tribel *et al.* 2001):

$$R = (\sum n \times b / N \times 9) \times 100$$

where n is the number of shoots, N is the total number of studied shoots and b is the scaled damage value (in points). Furthermore, $\sum n \times b$ represents the sum of products of the number of plants by the corresponding value of scaled damage and 9 is the highest value of the damage scale (Table 1).

**Table 1.** Scale of damage levels of plants caused by *Oligonychus ununguis* mites.

| Scale points of damage | Level of damage | Needle damage signs | Affected area (%) |
|---|---|---|---|
| **1** | very weak | a few spots | < 5 |
| **2–3** | weak | small, diffuse spots | 5–25 |
| **4–5** | average | merging spots | 26–50 |
| **6–7** | strong | most of the needle is damaged | 51–85 |
| **8–9** | very strong | all of the needle is damaged, needles | > 85 |

Selianinov's hydrothermal temperature coefficient (HTC) was used here (Selyaninov 1928). It is defined as the ratio of precipitation (*r*) in mm for a period with daily average temperatures above 10 °C to the sum of temperatures ($\sum t$) during the same time, reduced by 10 times, HTC = r/($\sum t$/10). To calculate HTC, we used data of the meteorological station of FBG. The average indicators of HTC for the seasons of 2012–2016 were used in the data analysis.

The diagrams and calculations of the dependence between the plants shoot length and the degree of *O. ununguis* infestation, and the effect of HTC on the spring emergence of larvae, were done in Microsoft Excel 2010.

## RESULTS AND DISCUSSION

In monitoring studies performed in Fomin Botanical Garden (FBG), *O. ununguis* was first recorded on plants of the genus *Pseudotsuga*. We found that the pest mites colonize plants of the genera *Picea* and *Pseudotsuga* differently; the latter was more damaged by the spruce spider mite.

In this study, the lowest and most severe damage for conifers was in 2013 and 2016, respectively. Eight varieties of the introduced genera *Pseudotsuga* and *Picea* of coniferous plants were chosen as study objects. The highest degree of damage caused by *O. ununguis* was observed on the plants of *Pseudotsuga menziesii* (Mirb.) Franco, *Ps. menziesii* var. *viridis* Franco, *Ps. menziesii* «*Glauca pendula*» and *Picea glauca* «*Conica*». No mites were found on the plants of *Pseudotsuga menziesii* var. *glauca* Franco (Fig. 1).

It was known that population density of *O. ununguis* on different species of spruce can be associated with the specifics of morphology and anatomy of the needle and with the biochemical differences of these plants (Puchalska 2006; Puchalska *et al.* 2008).

*Oligonychus ununguis* is found to mostly live at the base of needle of *Pseudotsuga menziesii* var. *viridis*. Hence, even at high abundance, the mites do not discolor the needles completely. This is opposite in plants of *P. glauca* «*Conica*», at which the mite feeding causes a strong browning of needles, and in five to eight days the plants lose their decorative value.

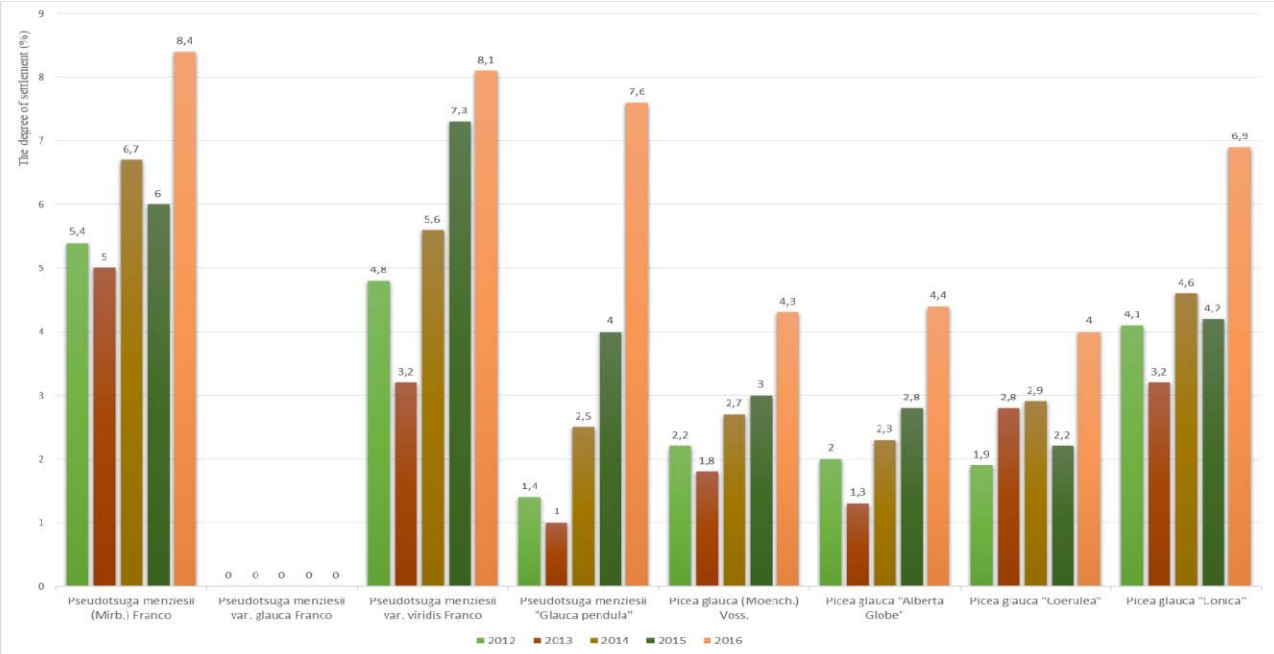


**Figure 1.** Density levels (%) of *Oligonychus ununguis* on host plants of species and subspecies of *Pseudotsuga menziesii* (Mirb.) Franco and *Picea glauca* (Moench.) Voss. in the Fomin Botanical Garden (2012–2016).

In the presence of *O. ununguis,* plant needles become more and more discolored and shoots growth is slowed. Based on the obtained experimental data, we found a dependence between the pest abundance and the plant shoot growth length. The regression equation shows that with the increasing mite infestation, the discoloration of plant shoots increases and shoot growth decreases. The dependence is strong according to the value of the coefficient of determination, $R^2$ = 0.8781 (Fig. 2, p = 0.046).

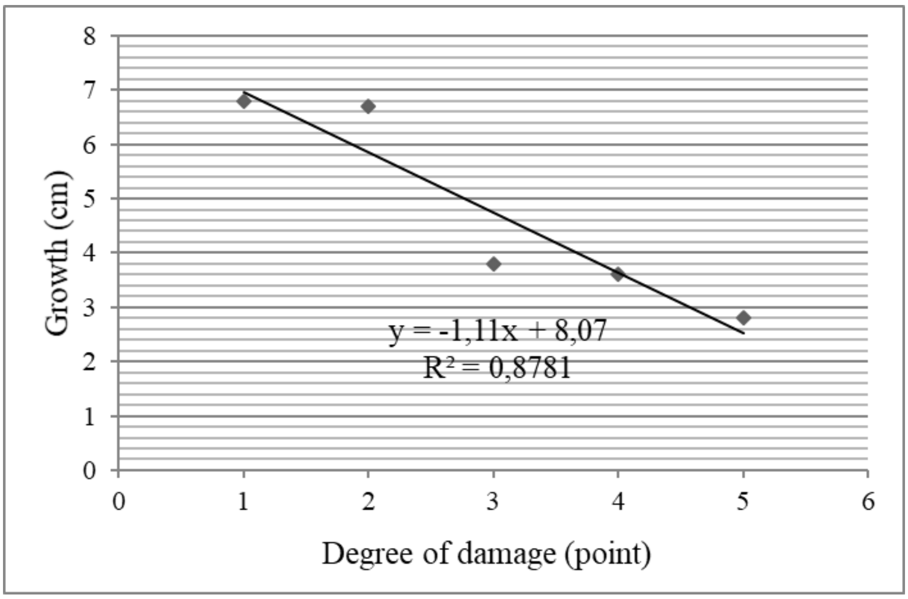


**Figure 2.** Relationship between shoot growth of *P. menziesii* var. *viridis* Franco plants and the level of damage caused by *O. ununguis*.

*Oligonychus ununguis* has seven to nine generations per year, depending on the climate conditions (Marshall 1986; Zavodchikova and Zavodchikova 2011). According to our data, this mite pest produces up to five generations per year in the Kyiv. The mites overwinter at the egg stage on last-year shoots near the buds, on covering scales and at the needle base.

It is known that the unfavorable abiotic and biotic factors reduce the mite abundance on plants. The abiotic factors include high air temperature during vegetation, periods of high moisture, heavy rains, strong wind, etc. The main biotic factor is the activity of natural enemies of spider mites (Calkin 1991; Abad-Moyano *et. al*. 2008; Fonseca *et al*. 2020).

The lower temperature threshold for the pest development is around 10 °C (Livshitz *et al.* 2011; Kiritani 2012). In this study, the female mites lay one egg per day, in very rare cases two or three eggs per day. The eggs are laid in a month or longer. The larvae of the first generation occur in the end of May. The optimum temperature for the pest development is 24–26 ˚C, with the relative humidity of 50-60% (Lehman, 2002). The populations of spruce spider mites mostly increase in spring and autumn. In summer, during the stable increase of temperatures, the density of *O. ununguis* population decreases, as was clearly seen in the study season of 2019. In July and August 2019, the air temperatures in Kyiv peaked at 30–32 ˚C, which slowed the mite development, suppressing its density and the levels of damage on the conifers.

The findings of Boyne and Hain (1983) support our observations about the mite egg mortality after exposure to temperatures higher than 29 ˚C under the laboratory conditions. Nevertheless, in nature some mites and eggs can persist in more protected, cooler micro habitats on host plants even in the extreme temperatures (Lehman, 2002). These surviving specimens restart the pest population when the temperatures allow, usually in the end of summer.

The timing of larval emergence in the spring, and the effect of temperature-related factors are important aspects of mite biology. According to Livschitz and Mitrofanov (1973) the spring larvae occur in the subtropical climate of the southern Ukraine in a month (from the middle of April to the middle of May), the postembryonic development proceeds in 18 to 22 days, and the first females occur in the end of May, at the beginning of June. The climate of Kyiv is temperate continental. According to the analysis of Kyiv's meteorological data, the lower temperature threshold of the pest development (10 °C) occurred mostly in April (except in May 2014). That threshold was exceeded in April 2012 (the earliest), 2013, 2015 and 2016. The fastest embryonic development (11 days) was observed in 2013, the longest (47 days) in 2016. Temperature dropped to the threshold of 10 °C in May 2015, and thrice in 2016 (April 22–24, 27–29, and May 19–21). Those cooler periods slowed the larval development.

Hydrothermal temperature coefficient (HTC) was used in order to summarize and compare the quantitative climate characteristics at certain critical periods of the life cycles of mites. The dynamics of HTC values from April to June are presented in Fig. 3. Calculated for the embryonic development of *O. ununguis*, they show that the lowest HTC value during April, May, and June were observed in 2013, and the highest in 2014 and 2016 (Fig. 3). The results shown in the graph (Fig. 4) indicate an insufficiently high connection between the start of hatching of mite larvae in spring and the HTC value. The coefficient of determination ($R^2$ = 0.6058) indicates that the linear model corresponds to statistics by 60.5 (p = 0.012).

Phytoseiid mites are very well known as effective natural enemies of plant pests (Putman 1959; Chant 1961, Huffaker *et al*. 1969; Croft and Nelson 1972; and many others). This group of predators is generally named as acariphagous because their feeding habits and residence under natural conditions in association with mites of other families, although representatives of some phytoseiids can eat of small insects in pre-adult stages too. The presence of 7 species of four genera of phytoseiid mites was established on 27 species of different conifers in botanic gardens of Ukraine (Kolodochka and Omery 2011).

In the present study, two species of the Phytoseiidae (Acari, Parasitiformes), *Typhlodromus laurae* Arutunjan, and *Amblydromella (Amblydromella) inopinata* (Wainstein), were observed on plants of the genera *Pseudotsuga* and *Picea*. These predatory mites give preference to coniferous plants and therefore they were present on plants across season 2019. Mites of *T. laurae* and *A. inopinata* can colonize the same host plant specimen together. The first species had a numeral superiority in a mixed population of both predators. Population of *T. laurae* was always nearly twice higher than of *A. inopinata* with small fluctuations.

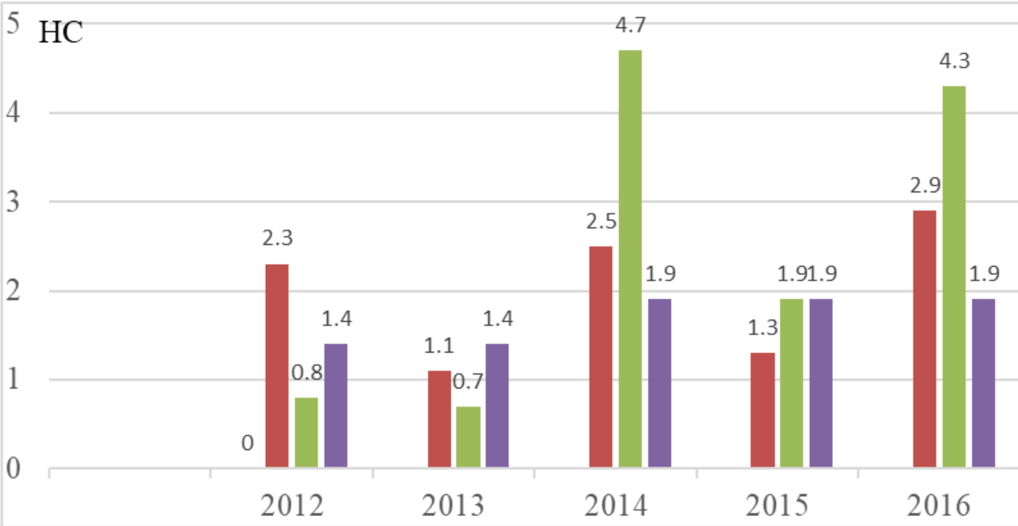


**Figure 3.** Hydrothermal coefficient (HC) values for periods after the threshold temperature of 10 °C (2012– 2016).

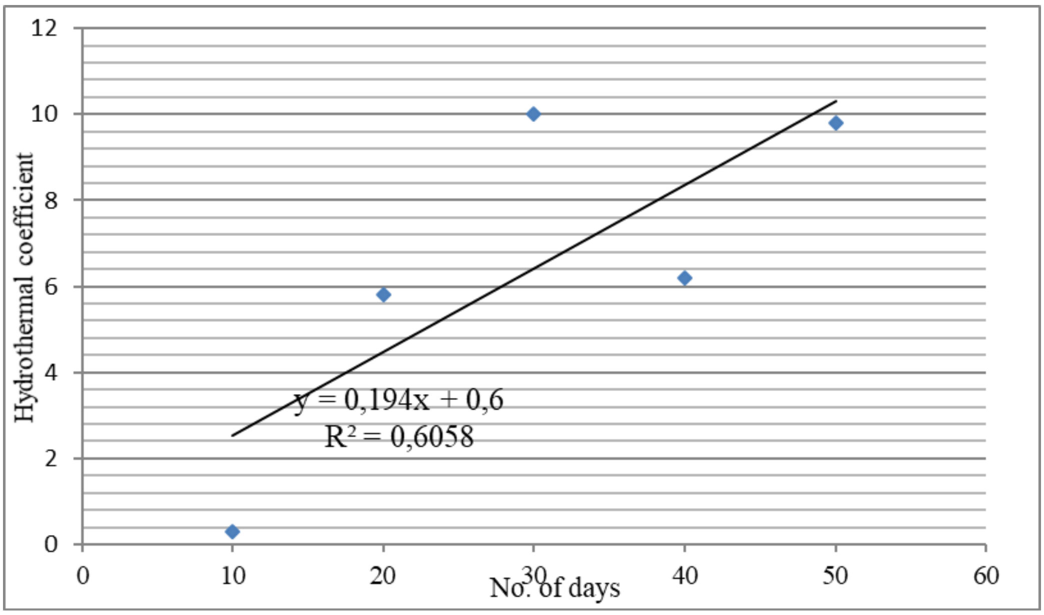


**Figure 4.** Relationship between the start of mass hatching of *O. ununguis* larvae and HC values at air temperature higher than 10 °C.

At the beginning of the season, the pest numerically prevailed at all stages of development, up to the absence of predators in some samples, then in the third quarter of the season the predator: prey ratio changed to the opposite. That is, some adult individuals of the phytophagous mite were present in the samples, but the juvenile prey was almost completely absent. It was observed in time of the late hot summer and the dry beginning of autumn. It should be noted these temperature conditions are not favorable for predatory phytoseiids. However, these conditions did not prevent to predaceous mites from lowering the population of the prey to such a level that only non-numerous surviving eggs of *O. ununguis* remained for overwintering.

Hence, according to the results of our studies, the spruce spider mite was found for the first time on plants of the genus *Pseudotsuga* in FBG. It was revealed that different species and varieties of conifers differ in attractiveness as host plants for this pest species. Given the trophic peculiarities of various phytophagous mite species, introducing varieties characterized by high decorative properties along with resistance to pests seems to be effective for plant protection in urban green areas.

In this study, a direct relationship was established between the growth of conifer shoots and the density of the pest population. The study of the influence of the HTC factor did not show a sufficiently high level of significance for determining the terms of mass hatching of spider mite larvae. The mites are dangerous even at a relatively low density; it is necessary to carry out control measures in order to prevent their negative impacts. Predatory mites of the family Phytoseiidae are able to effectively control the amount of *O. ununguis* on host plants of the genera *Picea* and *Pseudotsuga*, especially in the second half of the season.

## REFERENCES


Abad-Moyano, R., Pina, T., Dembilio, O., Ferragut, F. & Urbaneja, A. (2008) Survey of natural enemies of spider mites (Acari: Tetranychidae) in citrus orchards in eastern Spain. *Experimental and Applied Acarology*, 47(1): 49–61.
DOI: 10.1007/s10493-008-9193-3

Akimov, I.A. & Zhovnerchuk, O.V. (2010) *Tetranychid mites – pests of green plantations of megalopolis*. Kyiv, 135 pp. (In Russian with English Abstract).

Boyne, J.V. & Hain, F.P. (1983) Effects of constant temperature, relative humidity, and simulated rainfall on development and survival of the spruce spider mite (*Oligonychus ununguis*). *The Canadian Entomologist*, 115: 93-105.

Bondareva, L.M. & Chumak, P.Y. (2018) *Pentamerismus taxi* (Haller, 1877) (Acari: Tenuipalpidae): A new pest in the conditions of Kyiv. *Russian Journal of Biological Invasions*, 9 (1): 9–12.
DOI: 10.1134/S2075111718010034

Calkin, J.D. (1991) *Distribution of* Oligonychus ununguis *(Jacobi) (Acari: Tetranychidae) and predator mite species (Acari: Phytoseiidae) on field-grown Douglas-Fir (Pseudotsuga menziesii [Mirb] Franco) Christmas trees.* M. Sc. thesis, Oregon State University, 64 pp.

Chant, D.A. (1961) An experiment in biological control of *Tetranychus telarius* (L.) (Acarina, Tetranychidae) in a greenhouse using the predacious mite *Phytoseiulus persimilis* Athias-Henriot (Phytoseiidae). *Canadian Entomologist*, 93 (6): 437–443.

Croft, B.A. & Nelson, E.E. (1972) An index to predict efficient interactions of *Typhlodromus occidentalis* in control of *Tetranychus mcdanieli* in southern California apple trees. *Journal of Economic Entomology*, 65(1): 310–312.

Dmitriev, G.V. (1969) *The basics of protecting green spaces from harmful arthropods*. Kyiv, 411 pp. (In Russian with English Abstract).

Fenilli, R. & Flechtmann, C.H.W. (1990) Mites of *Araucaria angustifolia* in Lages, Santa Catarina. *Anais da Escola Superior de Agricultura 'Luiz de Queiroz'*, 47(1): 243-250.

Fonseca, M.M., Pallini, A., Marques, P.H., Lima, E. & Janssen, A. (2020) Compatibility of two predator species for biological control of the two-spotted spider mite. *Experimental and Applied Acarology,* 80: 409–422.
DOI: 10.1007/s10493-020-00472-8

Gutierrez, J. & Schicha, E. (1983) The spider mite family Tetranychidae (Acari) in New South Wales. *International Journal of Acarology*, 9 (3): 99–116.

Huffaker, C.B., van der Vrie, M. & McMurtry, J.A. (1969) The ecology of tetranychid mites and their natural control. *Annual Review of Entomology*, 14(1): 125–174.

Kiritani, K. (2012) The low development threshold temperature and the thermal constant in insects and mites in Japan (2nd edition). *Bulletin of National Institute for Agro-Environmental Sciences*, 31: 1–74.

Kolodochka, L.A. & Omery, I.D. (2011) *Predatory mites of the family Phytoseiidae (Parasitiformes) of dendrological parks and botanical gardens in the forest-and-steppe zone of Ukraine*. Kyiv, 192 pp. (In Russian with English Abstract).

Lehman, R.D. (2002) Spruce spider mite, *Oligonychus ununguis* (Jacobi) – an integrated approach to management Acarina: Tetranychidae. *Entomology Circular*, 24(1): 1–4.

Livschitz, I.Z. & Mitrofanov, V.I. (1973) Class Arachnida. *In*: Vasiliev, V.P. (Ed.), *Pests of agriculture and forest plantations. Vol. 1, Pest nematodes, mollusks and arthropods*, Kyiv, Urozhay, pp. 108–162 (In Russian with English Abstract).

Livschitz, I.Z., Mitrofanov, V.I. & Petrushov, A.Z. (2011) *Agricultural Acarology.* Moscow, 351 pp. (In Russian with English Abstract).

Loyttyniemi, K. & Hellov, K. (1991) Effect of forest fertilization on the spruce spider mite *Oligonychus ununguis* (Jacobi) (Acarina, Tetranychidae). *Acarologia*, 32(2): 139–143.

Marshall, V.G. (1986) Spruce spider mite in British Columbia. *Forestry Canada, Forest Insect and disease Survey, Forest Pest Leaflet*, 33: 4.

Migeon, A., Nouguier, E. & Dorkeld, F. (2011) Spider Mites Web: a comprehensive database for the Tetranychidae. *Trends in Acarology*, pp. 557–560.

Mitrofanov, V.I., Strunkova, Z.I. & Livschitz, I.Z. (1987) Key to tetranychid mites of the fauna of USSR and adjacent countries (Tetranychidae, Bryobiidae). Dushanbe, Donish, 223 pp. (In Russian with English Abstract).

Puchalska, E. (2006) The influence of *Oligonychus ununguis* Jacobi (Acari: Tetranychidae) on photosynthetic activity and needle damage of *Picea glauca* "*Conica*". *Biological letter*, 43(2): 353–360.

Puchalska, E. & Czajkowska, B. (2016) Degree-day model for predicting emergence of spruce spider mite (*Oligonychus ununguis* Jacobi) from overwintering eggs. *Progress in Plant Protection*, 56(2): 199–203.
DOI: 10.14199/ppp-2016-033.

Puchalska, E. Czajkowska, B. & Kiełkiewicz, M. (2008) Morphological, anatomical and chemical characterization of white spruce (*Piceaglauca* 'Conica') differently aged needles and hypotheses on their influence on *Oligonychus ununguis* infestation. *Acta Physiologiae Plantarum*, 30(2): 225–232.
DOI: 10.1007/s11738-007-0111-9.

Putman, W.L. (1959) Hibernation sites of phytoseiids (Acarina, Phytoseiidae) in Ontario peach orchards. *Canadian Entomologist*, 91(11): 735–741.

Richmond, D.S. & Shetlar, D.J. (1996) Eclosion time and spatial distribution of overwintering spruce spider mite (Acari: Tetranychidae) eggs on Colorado spruce. *Journal of Economic Entomology*, 89(2): 447–452.

Selyaninov, G.T. (1928) About climate agricultural estimation. *Proceedings on Agricultural Meteorology*, 20: 165–177.

Stephen, P. & Cook (1992) Influence of monoterpene vapors on spruce spider mite, *Oligonychus ununguis*, adult females. *Journal of Chemical Ecology*, 18: 1497–1504.

Sun, X.-G., Zhou, C.-G., Zhang, X.-D., Liu, Y.-M. & Mi, X.-M. (1995) A study on the diapause of *Oligonychus ununguis* (Jacobi). *Acta Entomologica Sinica*, 38(3): 30–311.

Tribel, S.O., Sigarova, D.D., Secun, M.P. & Ivashchenko, A.A. (2001) *Testing methods and use of pesticides*. Kyiv, 447 pp. (In Ukrainian with English Abstract).

Voitenko, A.N. (1969) *Dendrophilic Tetranichidae mites Polissia of Ukraine*. Kyiv, 17 pp. (In Russian with English Abstract).

Yuksel, B. & Ulusoy, H. (2000) Harmfulness and control of *Oligonychus ununguis* Jacobi in conifer forest in eastern Black Sea region of Turkey. *Orman Muhendisligi*, 36(9): 28–31.

Zhovnerchuk, O.V. (2013) Species diversity of tetranychid mites (Acariformes, Tetranychoidea) of Cherkasy, Ukraine. *Ukrainian Entomological Journal*, 2(7): 32–35 (In Ukrainian with English Abstract).

Zhovnerchuk, O., Dudinska, A. & Romanko, V. (2019) The study of the Tetranychid mites (Acari, Tetranychidae) in the Transcarpathian region (Ukraine). *Proceedings of the International zoological conference "Fauna of Ukraine at the turn of XX-XXI centuries, State and biodiversity of ecosystems of the nature conservation territories*", Lviv, pp. 82–85 (In Ukrainianan with English Abstract).

Zavodchikova, R.E. & Zavodchikova, S.A (2011) Mites living on spruces of Kyrgyzstan. *In*: Turdukulov, E.T. (Ed.), *Conservation and restoration of forests as important environmental and climate-regulating factor*. Proceedings of the International Scientific-Practical conference, dedicated to the 95$^{th}$ anniversary of Dr. Sc. PA Gan and to the International Year of Forests, Bishkek, pp. 79–82 (In Russian with English Abstract).

# ویژگی‌های دورهٔ زندگی و خسارت *Oligonychus ununguis* (Acari: Tetranychidae) روی گونه‌های وارداتی مخروطیان در شرایط ابرشهر

**لسیا ام. بونداروا[1*]، الگا وی. ژوونرچوک[2]، لئونید ا. کولودوچکا[2]، پترو یا. چومک[3] و اکسانا وی. زاوادسکا[1]**

*۱. گروه حفاظت تلفیقی و قرنطینهٔ گیاهی، دانشکدهٔ گیاهپزشکی، فناوری زیستی و اکولوژی، دانشگاه ملی علوم زیستی و محیطی، کیف، اکراین؛ رایانامه‌ها: zavadska3@gmail.com ،lnubip69@gmail.com*

*۲. گروه کنه‌شناسی، موسسهٔ شمالهوسن جانوری فرهنگستان ملی علوم اکراین، کیف، اکراین؛ رایانامه‌ها: olya@izan.kiev.ua ، leon@izan.kiev.ua*

*۳. گروه گیاهپزشکی و قرنطینه، دانشکدهٔ زراعت، دانشگاه ملی پولیسیا، ژیتومیر، اکراین؛ رایانامه: Chumakp@i.ua*

[*] نویسندهٔ مسئول

**چکیده**

جمعیت کنهٔ تارتن *Oligonychus ununguis* (Jacobi, 1905) روی گونه‌های وارداتی مخروطیان در باغ گیاهشناسی فومین، کیف، اکراین در سال‌های ۲۰۱۲–۲۰۱۹ بررسی شد. نمونه‌های کنه به روش تکاندن جمع‌آوری، ثابت و روی اسلاید نصب و سپس بر اساس روش‌های استاندارد مطالعه شدند. شدت خسارت (R, %) محاسبه شد. هشت رقم از جنس‌های وارداتی *Pseudotsuga* و *Picea* مخروطیان برای موضوع مورد مطالعه انتخاب شدند. آفت برای نخستین بار روی گیاهان جنس *Pseudotsuga* پیدا شد. مشخص شد که گونه‌ها و رقم‌های مختلف مخروطیان در جلب شدن به عنوان گیاه میزبان برای این گونه آفت تفاوت دارند. کنهٔ *O. ununguis* روی گیاهان *Pseudotsuga menziesii* ، *Ps. menziesii* var. *viridis* Franco ، و *Picea glauca* (Moench.) Vossf. «Conica» بیشترین فراوانی را داشتند. وابستگی آماره‌های رشد جوانه به انبوهی آفت بنابر میزان ضریب تعیین، $R^2 =$ ۰/۸۷۸۱ بسیار زیاد بود. جمعیت کنهٔ تارتن کاج در کیف در بهار و پاییز بسیار افزایش می‌یابد. در تابستان، افزایش دما به حدود ۳۰–۳۲ درجهٔ سلسیوس رشد کنه را آهسته کرده، انبوهی و میزان خسارت آن را محدود می‌کند. دو گونهٔ از خانوادهٔ Phytoseiidae، *Typhlodromus laurae* و *Amblydromella inopinata* و فعالیت آنها در کلنی‌های آفت روی گیاهان در سال ۲۰۱۹ مشاهده شد. این کنه‌های شکارگر می‌توانند با همدیگر روی مخروطیان مورد بررسی تجمع یافته و جمعیت *O. ununguis* را مهار کنند.

**واژگان کلیدی:** ضریب هیدروترمال؛ *Picea*؛ *Pseudotsuga*؛ کنه‌های تترانیکید؛ اکراین.

**اطلاعات مقاله:** تاریخ دریافت: ۱۳۹۹/۴/۲۴، تاریخ پذیرش: ۱۳۹۹/۵/۲۲، تاریخ چاپ: ۱۳۹۹/۷/۲۴