



UDC 595.42

SUSTAINABLE POPULATION OF *PENTAMERISMUS TAXI* (ACARI, TENUIPALPIDAE) BEYOND THE ZONE OF ITS NATURAL HABITATION IN UKRAINE

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Sustainable Population of *Pentamerismus taxi* (Acari, Tenuipalpidae) beyond the Zone of its Natural Habitation in Ukraine. Bondareva, L. M., Chumak, P. Y., Bondariev, S. I. — In 2010, *Pentamerismus taxi* (Haller, 1877) was revealed in the Acad. O. V. Fomin Botanical Garden (Kyiv). This is the northernmost border (51°31'N) of expansion of this phytophage in Ukraine. The mite most severely infests *Taxus baccata* L. plants and all varieties of this species. This mite has not been found on the plants of *T. canadensis* March. and *T. cuspidata* Siebold et Zucc. ex Endl. Appearance of a new dangerous pest requires further close study of this species.

Key words: Acari, *Pentamerismus taxi*, *Taxus*, Ukraine.

Introduction

Expansion of all living organisms depends on the totality of a number of biotic and abiotic factors, the most important of them being the weather conditions that determine the climate of a particular geographical area. The most significant of these are the temperature and humidity of the air. The habitat of each species is limited by a hygrothermal criterion, with its change the vital activity of individuals is significantly inhibited, and reaching a certain critical value leads to extinction.

In recent decades, climate change, primarily related to the overall climate warming and change in the amount of precipitation, has been observed. According to the IPCC (Intergovernmental Panel on Climate Change), in 1906–2005, the average temperature on the Earth increased by 0.74°. At the same time, the rate of warming in the second half of the century almost doubled: in the first 50 years of the century it was warming by 0.07 degrees per decade, during the last 50 years — by 0.13 degrees. In the future, the temperature will continue to grow.

In Ukraine, according to the data of the Hydrometeorological Center, the average annual air temperature has also increased by 0.7° C. The tendency towards warming has been especially pronounced in recent decades. Thus, after 1988, the average annual temperature has not dropped below 7 degrees.

Most herbivorous mites, being ectothermic organisms, essentially depend on the temperature of environment. Another important factor in their propagation and development is the hygrothermal regime of the territory, its violation inevitably leading to a shift in the boundaries of home ranges and expansion zones of certain species.

In the transformed environment, the aggressive qualities of invasive species are manifested to the greatest degree. They are changing their area, moving north, appearing in local “spots” of the environment favorable for them — in urban conditions, along transport routes, in suburban areas, etc. (Maslyakov, Izhevskiy, 2011).

The genus *Pentamerismus* McGregor, 1949 (family Tenuipalpidae) includes 22 species. All species of this genus are prevalent mainly in the tropical and subtropical zones of the Earth (Alatawi, Kamran, 2015). In Ukraine, by the data of Livshits, Mitrofanov (1973), only four species of this genus have been identified. The new cucujus is distributed in Japan, USA, Switzerland, Armenia, Korea (Lee Won-Koo and Lee Jeong-Sang, 1992), Georgia (Arabuli, 2015) and Turkey (Cobanoglu, Ueckermann and Saglam, 2016). In Ukraine it occurs in the parks of the southern coast of the Crimea, where it is a dangerous pest (Livshits, Mitrofanov, 1973). There fore *Pentamerismus taxi* (Haller) in Ukraine was not found above 44 ° of northern latitude (Simferopol City).

The aim of the work was to study the biology and trophic connections of *P. taxi*, which has been revealed by us quite far from its natural habitat in Ukraine.

Material and methods

The object of research was *Pentamerismus taxi*. Work on studying the fauna and biology of mites was carried out by the method of collecting the samples on plants in steady-state and route surveys of the Acad. O. V. Fomin Botanical Garden in 2010–2016.

Mites were collected by shaking off the branches onto black paper, followed by their collection with a dissecting needle, and by direct collection from the yew needle under a binocular microscope. The collected mites were placed in test tubes with labels and 70 % alcohol, covered with tight cotton plugs and stored in containers with alcohol of the same concentration prior to preparation.

In the laboratory treatment of the material, permanent preparations of the mites were mounted according to a traditional method using the Fora-Berlese liquid, repeatedly described in the literature (Methodological recommendations, 1981; Akimov, Zhovnerchuk, 2010). Quantitative indicators of the dependence of the number of mites from species, variety and form of plants were determined by counting the average number of individuals on 100 leaves (needles) of each plant species.

Results and their discussion

As a result of regular inspections of the phytosanitary condition of the plants of the Taxaceae L. family, which grow on the sites of the Acad. O. V. Fomin Botanical Garden, in 2010, for the first time, we detected *Pentamerismus taxi*. This mite damages the cortex of one-, two-year-old shoots and yew-needles. The damaged needles become yellow and prematurely fall off. The shoot cortex in the feeding places of the mites dies and cracks.

Female mite is orange-red, with oval body, squeezed in the dorsal direction, 0.3 mm long. The male is smaller and slimmer than the female, 0.2 mm long. It occurs very rarely in the colonies of mites, mainly in the second half of summer and in autumn. Egg is oval, orange-red, 0.1 mm long. The larva is bright red, with three pairs of legs, 0.15 mm long. Nymphs are colored lighter and brighter than females, four pairs of legs, body length is 0.2–0.3 mm (Livshits, Mitrofanov, 1973).

The studies, carried out by us in the Botanical Garden, made it possible to discover some peculiarities of colonization by *P. taxi* the species, forms and varieties of plants of the genus *Taxus* L. The mite severely damaged the plants of *Taxus baccata* L. and its varieties. On *Taxus x media* Rehder ‘Hicksii’ single individuals were noticed, and on plants *T. canadensis* March. and *T. cuspidata* Siebold et Zucc. ex Endl. phytophage were not revealed.

The density of mite population in different varieties of *T. baccata* in 2016 was the highest on *T. baccata* ‘Fastigiata aurea’ and *T. baccata* ‘Repandens’ (more than 8 ex./leaf). On the varieties *T. baccata* ‘Imperialus’, *T. baccata* ‘Ohlendorffii’, *T. baccata* ‘Fastigiata’, *T. baccata* ‘Overeyenderi’ and *T. baccata* ‘Schwazgrun’, the phytophage density reached 4–6 (ex./

leaf). Comparison of the average data of mite density on these varieties showed that the difference between them is statistically unreliable, i. e. the density of their colonization is similar in general terms.

It has been established that the first overwintered females of *P. taxi* appear in the middle of April and begin laying eggs at the air temperature of +10 °C and higher. The majority of eggs (70–80 %) the female lay in the cortex deepening of two-year shoots. Against the background of the green cortex, they are clearly visible in the form of orange-red dots.

The first bright red mites were observed during the second half of May. Mite with flat body under the conditions of Kyiv has one generation. By the data of I. Z. Livshits and V. I. Mitrofanov (1973) on the southern coast of the Crimea, depending on the temperature regime of the spring period, the phytophage develops 1–2 generations. In conditions of late cold spring, mites reach the imaginal stage only in August and pass the winter without laying eggs.

Mites, due to their huge diversity, small size and hidden lifestyle, are often entered into new regions, reaching far beyond their primary ranges. But not all species survive and are dangerous. Hundreds of species settle in, dozens become economically important and only a few pose the greatest threat to crop production.

According to our observations, mite *P. taxi* tends to create a stable population in the conditions of the Acad. O. V. Fomin Botanical Garden, located in the center of Kyiv with coordinates 51°31' of northern latitude and 31°30' of eastern longitude.

According to long-term forecasts, Ukraine is expecting the climatic changes in the 21st century, contributing to rise of summer temperatures and chronic droughts. This means that range boundaries of the thermophilic species, such as *P. taxi*, which can turn into a serious plant pest, will be expanding. Perhaps, it will gradually populate all regions suitable for its survival. Therefore, it is necessary to carefully study the ecology of *P. taxi*, in particular the development and ability to survive at different temperatures and humidity, as well as to assess the variation of these values in different regions of Ukraine and neighboring countries, especially at the boundaries of their contemporary ranges.

Hence, in the Acad. O. V. Fomin Botanical Garden *P. taxi* has been revealed for the first time. It has been established that phytophagous tends to create a stable population in the conditions of the Botanical Garden. This is facilitated by a number of circumstances: climate warming, introduction of plants and features of the species etiology.

The mite most severely damaged plants *Taxus baccata* and all cultivated varieties of this species. On plants *T. canadensis* and *T. cuspidata* phytophage has not been revealed.

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Received 10 June 2017

Accepted 24 October 2017