

# HISTORY OF PHYTOPHAGOUS MITES IN ORCHARDS OF NORTHERN FOREST- STEPPE OF UKRAINE

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*The authors consider the changes in the phytophagus mites species composition in the Ukraine's northern forest-steppe during the latest decades. Their amount dynamics has been analyzed. The factors and reasons of its changes have been substantiated.*

**Keywords:** *herbivorous mites, apple, population dynamics, weather conditions, acaricides, forecast of development.*

Leaves and fruits of apple trees is an extremely valuable feed substrate, and therefore there are found about 60 species of insect pests in its plantations, the most dangerous are: codling moth, leaf-eating leafrollers, aphids, brant goose, snout beetle, apple blossom weevil, sawflies, moths and many others species. In such orchards there were found almost 20 species of phytophagus, predatory and other species of mites. Thus it is necessary to note that by the literary sources, there were no species of herbivorous mites could be called pest till 1950, while insects damaged foliage and fruits of apple, significantly reducing the productivity of plantations.

Wide use in apple plantations originally chlororganic, and then phosphororganic and pyretroid pesticides for pest population struggle in fruits orchard led to mass reproduction of herbivorous mites. Herbivorous mites became permanent components of apple agrocenosis. Among them the most dangerous there is the superfamily Tetranychoida Donn. In the area of the northern forest-steppe of Ukraine in the fauna of fruit trees there are red fruit (*Panonychus ulmi* Koch.), hawthorn (*Amphitetranynchus viennensis* Zacher), ordinary arachnoid (*Tetranychus urticae* Koch), garden arachnoid (*Schizotetranychus pruni* Oudms.), and brown fruit (*Bryobia redicorzevi* Reck.) mites have economic significance.

The damage caused by herbivorous mites negatively effect on vital activity of fruit trees. In case of dense settlement of mite fruits became shallow, harvest is reduced both in the current and in future years. According to Livshitz Z.S tetranhydroid mites in terms of Crimea are able to reduce the harvest of apple trees by 56% [2]. Mites damage negatively impact at growth and development of plants. Thus, at the average number of mites per plant (7-8 individuals per leaf) according to Yanovsky Y.P. in transplants were observed reducing of total leaf surface area by 34%, annual increase - 25%, and thickness - 11% in comparison to the unpopulated transplants [3].

Scientists in many countries attach great importance to the study of mites. By materials of researches were published over a thousand articles and monographs. Almost completely determined the species composition of mites at fruit plantations. The features of morphology, biology and effectiveness of almost all acaricides and insektoacaricides were studied.

***Aim of the work*** – to show the history of development, reasons for mass reproduction and changes in species composition of herbivorous mites in apple orchard biocenoses in northern forest-steppe Ukraine in the last decades.

***Methods of research.*** Studies were conducted during 1972-1976, 1997-1998 and 2011-2012 in the industrial apple plantations of experimental farm "Novosilky" Institute of Horticulture NAAS. To determine the species composition of mites were collected leaves of apple. For 1 sample were collected 50 apple tree leaves of different varieties (10 leaves from 5 trees) randomly on the perimeter of the crown, from different tiers. After selection leaves were put in a plastic bag with a label. The label stated the date of sampling, sort. Package with leaves were kept in a refrigerator at  $+4 \pm 6^{\circ}\text{C}$ . In laboratory conditions leaves was examined under a microscope and micropreparates were made by the generally accepted methods. The fertility of females of hawthorn fruit and red mites was determined by the method of Behlyarova (adhesive gardens). These data were recorded in the log-book.

**Results of researches.** The study of acaricides fauna of apple trees started in 1972 in the experimental farm "Novosilky" Institute of Horticulture NAAS. In the held accountings in the apple orchard were found phytophagous mites of the family Tetranychidae and Bryobiidae, namely the following types: *Panonychys ulmi* Koch., *Amphitetranychus viennensis* Zacher., *Tetranychys urticae* Koch., *Bryobia redicorzevi* Reck. Among the predatory mites we came across: *Typhloctonus formosus* Wain, *Typhlodromus rodovae* Wain. Et Arut., *Metaseiulus longipilus* Nesbitt of family Phytoseiidea, and the family Stigmaeidae - *Zetzelia mali* Ewing. There were mites - *Myxophaga* from the family Tydeidae (*Tydeus californicus*). Mites of the superfamily Eriophyoidae we have not investigated.

Among these species of mites in the first place deserves attention fruit brown mite. This species was accounted with single examples and not caused any harm by 1950 in fruit plantations. Since the beginning of the use of DDT and its analogs number of species increased. Five years later gardens processed with chlororganic pesticides became marbled and the number according to the report of the Institute of Horticulture ranged from 20-35 examples of all stages of development on one leaf. Thereby using the chlororganic preparations to protect the garden from harmful insects, we have contributed to the emergence of a new pest, which became a brown bag mite. The harmful effect of this type continued for around 10 years, but with the introduction of organophosphorus pesticides (karbofos, metaphos, rohor etc.) the maximum number of brown fruit mite was 1.7 ind. / leaf and then this species remained only in launched gardens.

Proceeding from the above information, we were interested in the causes of the disappearance of a brown fruit pest mites. It is believed that the reason for his appearance in farmland, as the pest, were chlororganic pesticides and disappearance - organophosphorus ones, and the factors that contributed to the massive development of this species find in its parthenogenetic way of reproduction and predatory mites. Other explanations we have not found, and

have not been able to conduct the research, though according predatory mites we have another opinion.

In the accountings conducted in the period from 1972-1976's it was found that in fruit plantations of Polissya and forest-steppe of Ukraine instead of brown fruit mite began to dominate the following species: hawthorn, red fruit and the usual arachnoid mites, which complement each other and become noticeable pests of apple orchard. These types of mites are characterized by different resistance to changes in temperature and humidity, as well as for different weather conditions in the gardens will be found one of these mites. For optimal development of hawthorn mite required temperature 19-22<sup>0</sup>C at 60-85% relative humidity; for red fruit 12-17<sup>0</sup>C, and relative humidity of 80-90% [4]. The optimal conditions for the development of ordinary arachnoid mites is temperature 19-25<sup>0</sup>C. With an increase in average air temperature to the 25<sup>0</sup>C, and to the maximum 34<sup>0</sup>C, and the relative humidity of 30-60% of the population is marked depression of this type of mite.

Analyzing the meteorological conditions of the years it is evident that they were close to optimal for herbivorous mites. If to take to consideration that given data are from stationary meteorological point, then in fruit plantations they can change at 1-3<sup>0</sup>C, depending on the shape of the crown, the density of vegetation, soil moisture. However, it must be noted that the dominant species in this period were hawthorn and the usual orachnoid mites. The population dynamics of herbivorous mites in the complete circuit of pesticides use. Despite holding six sprayings in the garden against pests, the number of mites in these years remained high. Special attention is required the indicators obtained in the second half of 1972, 1973 and 1975, where the population density mites on leaves amounted accordingly 63,8; 42,3; 37,8 ind./leef. Such population primarily caused ordinary arachnoid mite, females of which migrate to weeds in spring (thistles and *Convolvulus arvensis*), where they feed, and strenuously reproducing, forming large colonies. Only in the period of supply reserves decreasing on weeds and their destruction or burning

out during the summer, the reverse migration of mites on trees occurs. Here they rapidly reproduce, release large amounts of cobwebs. This also contributes to the high temperature and low relative humidity. Therefore, the increase in the number of species observed usually in second half of summer.

In this case, at the control plot, where were not used pesticides, mite density remained very low. In literary sources there are judgments that the reason for this phenomenon is predatory mites of the family fitoseyid, which have been destroyed in orchards at the application of insectoacaricides. However, in our numerous researches predatory mite *Typhloctonus formosus* Wain. and other types only once in the spring completely cleared the trunks of fruit trees from hawthorn and ordinary arachnoid mite, at a ratio of 1:23. During the vegetation period predatory mites can regulate the number of herbivorous ones, but only with a significant reduction of chemical pressure, but never completely solve the problem of harm of herbivorous.

Another reason for mass reproduction of herbivorous mites in orchards in Ukraine is the fecundity of females of hawthorn, red fruit, and other types of mites treated with insectoacaricides directly on foliage. Their application in gardens causes a death of females harmful mites, but the fertility of the population that survived increased 2-4 times or more, relatively to non-treated.

Over the last 15 years in industrial plantations of Ukraine there were severe oscillation of hawthorn, ordinary arachnoid mites and red fruit and it was due, in the first place, the meteorological conditions. Meteorological conditions in the region during 1997-1998 researches (Average daily temperature within 13,8-19,5<sup>0</sup>C, precipitation - 409,3-357,55 mm during the vegetation period) were very favorable for fruit red mite. The number of mobile species of herbivorous mites in 1997-1998. 22,9-14,5 averaged ind./leaf. The development of mites was characterized by the presence of mass peaks numbers, which exceeded the economic threshold of harmfulness. It is needed to use acaricides in gardens. Analyzing the records of materials held by

us in the apple orchard experimental farm "Novosilky" Institute of Horticulture NAAS in 2011-2012 concerning the density of colonization of apple leaves herbivorous mites, it should be noted that it is significantly decreased in comparison to previous years. In 2010-2012 it was found low numbers of phytophagous mites (on average 0,7-1,1 ind./leaf).

Such a low mites population density on trees has several reasons. Firstly, to unfavorable weather conditions for mites which have developed in the previous and current year. The vegetative season in 2010 in a region of research was characterized by extreme aridity and high average daily temperatures in comparison with the previous years and average long-term indexes. Since early July average decade temperatures exceed  $+25^{\circ}\text{C}$ . On some days in July and August maximum temperature reached  $38^{\circ}\text{C}$ . Average monthly indicators of relative humidity from June to August in the range of 26-52%. Such weather conditions have caused a depression of red fruit, hawthorn and ordinary arachnoid mites.

At early spring accountings in 2011 was found that 97% of the overwintering stages of hawthorn and ordinary arachnoid mite killed in winter. During this period, the temperature was reduced to  $-28,4^{\circ}\text{C}$ . First half of March was also cool (min. temperature dropped to minus  $12,0^{\circ}\text{C}$ ). With such death of pest population number during the vegetative season is practically not restored to critical levels.

The dominant species among herbivorous mites in apple orchards of northern forest-steppe of Ukraine in the last decade was a red fruit mite. But the weather conditions of recent years seemed not very favorable for the development of this species. In the accountings held in the second half of May, it was found that the pest populated from 0,02 to 4,0% of apple leaves. During the vegetative season population density of leaves remained low. The main factors that limited its development was high temperature in summer and low its relative humidity, lack of watering in the garden and reduce of the use of organophosphorus and pyretroid pesticides. Red fruit mite is a hihrofilic

species, and therefore during the June rains we have seen its reproduction, but the high July temperature at low relative humidity caused the death of the larvae of mites.

In 2010-2012 ordinary arachnoid mite was met in fruit plantations as a species, but the harm was not economically noticeable. The limiting factor in its development were the weather conditions in recent years. Over the last 2 years high temperature and low humidity have been extremely detrimental to the development of red fruit mite, because their numbers were low. Only ordinary arachnoid mite can survive and develop in such weather conditions.

**Conclusions.** 1. Thus, the main factors regulating the number of herbivorous mites in orchards are weather conditions, insectoacaricides application, their multiplicity, and partially the activity of predatory mites.

2. The main reason for mass reproduction of herbivorous mites is fertility of females that were processed with insectoacaricides.

3. Reduction of technical efficiency of insectoacaricides till 65-70% indicates the emergence of resistant individuals in populations of herbivorous mites and subsequent use of preparates is inappropriate.

4. The system of measures to protect fruit trees from pests must should include careful phytosanitary monitoring of population number of mites for a whole season of vegetation, especially in conditions of climate changes.

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## **ІСТОРИЯ РОЗВИТКУ РОСЛИНОЇДНИХ КЛІЩІВ У САДАХ ПІВНІЧНОГО ЛІСОСТЕПУ УКРАЇНИ**

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*Розглянуто питання зміни видового складу рослиноїдних кліщів у північному Лісостепу України, що відбулися за останні десятиріччя. Проаналізовано динаміку їх чисельності. Обґрунтовано фактори та причини, що сприяли змінам чисельності рослиноїдних кліщів у плодкових насадженнях України.*

**Ключові слова:** *рослиноїдні кліщі, яблуня, динаміка чисельності, метеорологічні умови, акарициди, прогноз розвитку*

## **ИСТОРИЯ РАЗВИТИЯ РАСТИТЕЛЬНОЯДНЫХ КЛЕЩЕЙ В САДАХ СЕВЕРНОЙ ЛЕСОСТЕПИ УКРАИНЫ**

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Рассмотрены вопросы изменения видового состава растительноядных клещей в северной Лесостепи Украины, произошедшие за последние десятилетия. Проанализирована динамика их численности. Обоснованы факторы и причины, способствовавшие изменениям численности растительноядных клещей в плодовых насаждениях Украины.

**Ключевые слова:** *растительноядные клещи, яблоня, динамика численности, метеорологические условия, акарициды, прогноз развития*