

CURRENT STATUS AND TENDENCIES IN DIVERSITY AND TROPHIC SPECIALIZATION OF TETRANYCHIDAE MITES (ACARI, TETRANYCHIDAE) OF THE STEPPE ZONE OF UKRAINE

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A long term research data overview devoted to Tetranychidae mites of the steppe zone of Ukraine with emphasis on species composition, abundance, trophic specialization of 40 mite species from 13 genera.

Key words: Acari, Tetranychidae, species, trophic, steppe, Ukraine.

Сучасний стан і тенденції змін різноманіття та трофічної спеціалізації тетраніхових кліщів (Acari, Tetranychidae) у степовій зоні України

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Узагальнено дані багаторічних досліджень тетраніхових кліщів у степовій зоні України. Проаналізовано зміни видового складу, чисельності, трофічної спеціалізації кліщів 40 видів із 13 родів.

Ключові слова: Acari, Tetranychidae, вид, трофіка, степ, Україна.

Современное состояние и тенденции изменений разнообразия и трофической специализации тетраниховых клещей (Acari, Tetranychidae) в степной зоне Украины

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Обобщены данные многолетних исследований тетраниховых клещей в степной зоне Украины. Проанализированы изменения видового состава, численности, трофической специализации 40 видов из 13 родов.

Ключевые слова: Acari, Tetranychidae, вид, трофика, степь, Украина.

Sound research devoted to Tetranychidae mites of the steppe zone of Ukraine was launched in 1961 by one of the authors of this publication (Akimov, 1965). Before that there was information only on Tetranychidae, damaging fruit crops in Ukrainian steppe zone and in the southern Crimea: *Tetranychus urticae*, *Bryobia redikorzevi*, *Amphitetranychus vieenensis*, *Eotetranychus pruni* and others (Zgerskaya, 1959; Livshits, 1964). However, the well-planned and completed study of steppe zone herbivore mites was not carried out for almost half a century. In the late 80's early 90's acarology department staff worked over predacious phytoseid mites in the Black Sea Biosphere Reserve, therefore herbivorous Tetranychidae, which at that time remained undetermined were found in the department collection (L. Bondarenko and L. O. Kolodochka, collections of 1989, 1991 and 1992). In the 2011–2013 phytoseid mites were collected in the Eastern Steppe region of Ukraine and Tetranychidae were also found in the samples (L. O. Kolodochka, V. Yu. Bondarev collections of 2011–2013.). The part of alcohol fixed samples, which contained Tetranychidae, was kindly given by S. G. Pogrebnyak, who also collected steppe zone mites of different genera (collections of 1989, 1991, 2006–2008). O. V. Zhovnerchuk made targeting collecting of Tetranychidae steppe zone mites to fill existing gap in the study of practically important group of herbivores, inhabited these areas in 2012 and 2015.

Material and methods. Tetranychidae species composition of steppe zone of Ukraine was determined on the basis of collections stored at Schmalhausen Institute of Zoology NAS of Ukraine, National Museum of Natural Sciences of Ukraine, analysis of earlier material (I.A. Akimov, 1965) and latest field collections (O.V. Zhovnerchuk, 2012, 2015). Material collected in Dnipropetrovsk,

Donetsk, Luhansk, Mykolaiv, Kherson and Odessa regions in 1961–1963, 1989, 1991–1992, 2007–2008, 2011–2012, 2015 were worked up (collection of 1961–1963 was identified by I. A. Akimov; other collections were identified by O. V. Zhovnerchuk). Overall, more than two thousand species of mites were examined. Species identification was carried out using phase-contrast method and light microscope Optica B-350.

In our earlier publications on Tetranychidae mites classification was given according to B. A. Wainstein (Wainstein, 1960) and V. I. Mitrofanov (Mitrofanov et al., 1987). Later, the views on Tetranychidae taxonomy were slightly revised, and the names of several species were synonymized. For example, *T. cinnabarinus* Boisduval (1867) received the status of a junior synonym of *T. urticae* Koch (1836) (Dupont, 1979; Auger et al., 2013), and *B. redikorzevi* Reck (1947) — *Bryobia rubrioculus* correspondingly (Scheuten, 1857). In this publication we adhere to the modern classification (Krantz, Walter, 2009; Migeon, Dorkeld, 2006–2016).

Results and discussion. In the steppe zone of Ukraine 17 species of 7 families of mites were found during field research (Akimov, 1965). The further processing of collected material stored at the Schmalhausen Institute of Zoology NAS of Ukraine and the National Museum of Natural Sciences of Ukraine, as well as O. V. Zhovnerchuk's collection (2015), gave an opportunity to identify 36 Tetranychidae mites species and complement existing list by 24 new species and 6 genera. Thus, 40 species of 13 genera of Tetranychidae mites inhabited steppe zone of Ukraine are currently known:

Amphitetranychus savenkoae (Reck, 1956), *A. viennensis* (Zacher, 1920), *Eurytetranychus buxi* (Garman, 1935), *E. recki* (Bagdasarian, 1948), *Oligonychus mitis* (Beglyarov & Mitrofanov, 1973), *O. piceae* (Reck, 1953), *O. pinaceus* (Mitrofanov & Bossenko, 1975), *Panonychus ulmi* (Koch, 1836), *Eotetranychus carpini* (Oudemans, 1905), *E. colurnae* (Mitrofanov, 1978), *E. fraxini* (Reck, 1948), *E. populi* (Koch, 1838), *E. pruni* (Oudemans, 1931), *E. rajae* (Wainstein, 1956), *Schizotetranychus garmani* (Pritchard & Baker, 1955), *S. ibericus* (Reck, 1947), *S. malkovskii* (Wainstein, 1956), *S. schizopus* (Zacher, 1913), *S. spireaefolia* (Garman, 1940), *Tetranychus frater* (Garman, 1940), *T. lonicerae* (Beglyarov & Mitrofanov, 1973), *T. przhevalskii* (Reck, 1956), *T. similis* (Wainstein, 1958), *T. turkestanii* (Ugarov & Nikolskii, 1937), *T. urticae* (Koch, 1836), *Tenuipalpoides zizyphus* (Reck & Bagdasarian, 1948), *Petrobia latens* (Müller, 1776), *P. zachvatkini* (Reck & Bagdasarian, 1949), *Mesobryobia terpogossiani* (Bagdasarian, 1959), *Aplonobia richteri* (Bagdasarian, 1954), *A. shirakensis* (Reck, 1956), *Bryobia graminum* (Schrank, 1781), *B. lagodechiana* (Reck, 1953), *B. longisetis* (Reck, 1947), *Bryobia rubrioculus* (Scheuten, 1857), *B. rugosa* (Livshits & Mitrofanov, 1966), *B. ulmophila* (Reck, 1947), *Tetranychopsis horridus* (Canestrini & Fanzago, 1876), *T. hystericiformis* (Reck, 1956), *T. spiraeae* (Reck, 1948)¹.

Along the field researches in the Ukrainian steppe zone, new untypical species of Tetranychidae mites were registered. Earlier the nearest findings for these species were Georgia (*A. shirakensis*, *E. recki*, *T. zizyphus*), Armenia (*A. richteri*, *M. terpogossiani*) and Primorsky Krai (Far East), Russia (*T. lonicerae*) (Mitrofanov et al., 1987; Zhovnerchuk, 2012, 2014 (2016); Migeon, Dorkeld, 2006–2016).

Tetranychus and *Bryobia* genera are represented by the largest number of species. Seven families are composed of one or two species only. Species composition of mites collected in given years is significantly different (Table. 1). Four species among recorded in 1961–1963 were not recorded later: *E. buxi*, *T. frater*, *E. rajae*, *E. pruni*. A strict monophage *E. buxi* inhabits only the box-tree. In our opinion its presence in the steppe zones of Ukraine is obvious, but the cause of its absence in the collection materials 1989–2015 is the lack of the box-tree among the host plants. *E. rajae* — also monophage, was detected in Kherson region on the eastern hornbeam (*Carpinus orien-*

talis) in 60th years last century and wasn't met later. As for the other two polyphage species, despite of inherent polyphagiya, they weren't observed in the steppe areas during the years of their general mass reproduction.

Six of forty spider mites species always marked in the lists related to all time periods of the study: (*A. savenkoeae*, *T. przhhevskii*, *T. similis*, *T. turkestanii*, *P. latens*, *P. zachvatkini*). *A. savenkoeae* recorded only in southern Kherson region of Ukraine from the 60s years of the last century (Akimov, 1965) is still registered on oaks (*Quercus* sp.) in the Black Sea Biosphere Reserve in noticeable quantity (Zhovnerchuk, 2014 (2016)). *T. przhhevskii* widespread in the steppe zone feeds on the sap of various grains (*Poaceae*), which are most prevalent in the region. The rest of these species belong to broad polyphage mites and often occur in the steppe.

Among steppe zone Tetranychidae mites 29 species feed on trees and bushes, and 19 feed on grass. Seven species of herbivores were found on both types of vegetation; however, with a tendency to show a preference to one type. For example, the idea that *T. urticae* damages tree plants first, while *T. turkestanii* associated mostly with herbaceous (Akimov, 1965; Popov, 1985) is confirmed by this study too. Nowadays there is a tendency for expansion of mites–host plants relationships for some Tetranychidae species. For example, *P. latens* in the 60s of the last century was registered in large number only for grains in Kherson region (Akimov, 1965) and now is recorded in bushes (*Cytisus* sp.) (Zhovnerchuk, 2014 (2016)). *P. zachvatkini*, found in the Caucasus on various herbs, registered only on *Consolida* sp. in Ukrainian steppe in the middle of 20th century, and according to recent research was found on the blackthorn (*Prunus* sp.), rosemary-leaved willow (*S. rosmarinifolia*), licium (*Lycium* sp.), tansy (*Tanacetum* sp.), wormwood (*Artemisia* sp.). New host plants — *Artemisia marschalliana*, *Jurinea longifolia*, *Grataegus* sp. were detected for the species *M. terpogossiani*, *A. richteri* and *T. spiraeae* correspondingly (Zhovnerchuk, 2012, 2014 (2016)). Pretty actively *E. recki* invades steppe areas. Found first in Ukraine in 2007 (Zhovnerchuk, 2014), *E. recki* is often present in the materials of further collections, especially in the eastern steppe, and is characterized by a wide range of host plants: knapweed (*Centaurea* sp.), oak (*Quercus* sp.), caragana (*Caragana* sp.), field maple (*Acer campestre*), alfalfa (*Medicago* sp.), oregano (*Origanum vulgare*), robinia (*Robinia pseudoacacia*). Accepted earlier Tetranychidae subdivision on trophic groups (Akimov, 1965) can not be considered absolute taking into account mites host plants expansion and their trophic specialization.

Long-term monitoring has shown that the most widespread steppe Tetranychidae which can considerably damage cultural and wild plantings are: *T. przhhevskii*, *T. similis* and *T. turkestanii*. Presence of herbivores on the crop plant leaves can reach 70–100% and 30–80% on the wild one (Akimov, 1965; Zhovnerchuk, 2014 (2016)). Among conifers, which are mainly represented by artificial plantations of pine, two Tetranychidae species were found — *O. piceae* and *O. pinaceus*, and the first one can cause serious damages of plants (Zhovnerchuk, 2014 (2016)).

Note ¹: 38 species of Tetranychidae mites were identified for the steppe zone of Ukraine in our last publication (Akimov, Zhovnerchuk, 2016). After analysis of the collection material provided by our colleagues, two species were found out.

Table 1

Tetranychidae species composition and distribution by collecting periods and type of vegetation

Species	Material collecting periods			Type of vegetation	
	1961–1963	1989–1992	2007–2015	Trees and shrub	Herbs
<i>A. savenkoae</i>	+	+	+	+	
<i>A. viennensis</i>	+		+	+	
<i>E. buxi</i>	+			+	
<i>E. recki</i>			+	+	+
<i>O. piceae</i>			+	+	
<i>O. pinaceus</i>			+	+	
<i>O. mitis</i>			+	+	
<i>P. ulmi</i>		+	+	+	
<i>E. fraxini</i>			+	+	
<i>E. carpini</i>			+	+	
<i>E. colurnae</i>			+	+	
<i>E. populi</i>	+		+	+	
<i>E. pruni</i>	+			+	
<i>E. rajae</i>	+			+	
<i>S. garmani</i>			+	+	
<i>S. ibericus</i>			+	+	
<i>S. malkovskii</i>		+	+		+
<i>S. schizopus</i>	+		+	+	
<i>S. spireaefolia</i>			+	+	
<i>T. cinnabarinus*</i>	+				+
<i>T. frater</i>	+				+
<i>T. lonicerae</i>		+			+
<i>T. przhevalskii</i>	+	+	+		+
<i>T. similis</i>	+	+	+	+	+
<i>T. turkestanii</i>	+	+	+	+	+
<i>T. urticae</i>	+		+	+	+
<i>T. zizyphus</i>			+	+	
<i>P. latens</i>	+	+	+	+	+
<i>P. zachvatkini</i>	+	+	+	+	+
<i>M. terpoghossiani</i>			+		+
<i>A. richteri</i>			+		+
<i>A. shirakensis</i>			+		+
<i>B. graminum</i>	+		+	+	+
<i>B. lagodechiana</i>		+			+
<i>B. longisetis</i>			+		+
<i>B. rubrioculus</i>	+		+	+	
<i>B. rugosa</i>		+			+
<i>B. ulmophila</i>			+	+	
<i>T. hystriciformis</i>		+	+		+
<i>T. spiraeae</i>			+	+	
<i>T. horridus</i>		+	+	+	
Всього	17	13	33	29	19

Note: (+) – species presence; * - accepted as a junior synonym of *T. urticae* (Auger et al., 2013).

In Ukraine until recently *S. malkovskii* was recorded on *Bolboschoenus* sp. in the floodplain of the river in Luhansk region (Akimov, 1965), while nowadays the species is considerably expand-

ed in range of host plants and increased in number. Status of conventional steppe plant species acquired *B. longisetis* — on *Salvia* sp. and *T. hystriciformis* — on herbaceous plants. Recorded in the 60-th of the last century as the dominant species *A. viennensis*, *B. rubrioculus* and *P. latens*, according to the latest observations occur frequently, but in moderate number. *P. ulmi* and *T. urticae*, in spite of the inherent eurytopic, also have a low number. The rest of the species found in the steppe today are rare for this area now, but that does not exclude possible changes in their status in future.

Our research covers more than 50-year study of the Tetranychidae mites in the Ukrainian steppe area and reveals changes in Tetranychidae ecology. In our opinion, they are caused primarily by mites variability and adaptive potential to environmental changes. As a result we observe: increasing of species diversity, shift towards species typical to southern regions earlier, acquiring ordinary status for rare species, expansion of mites forage resources and changes in their trophic specialization.

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