MITES OF FRUIT PLANTATIONS OF THE REPUBLIC OF MOLDOVA

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Abstract. Mite fauna of fruit plantations of the Republic of Moldova consists of 132 species belonging to 15 families collected during the period 1995-2010. 87 species of rare mite species were registered. Trophic specialization of mites was revealed in terms of occurrence: the main species - above 7%, sporadic species - less than 4%, associated species - from 4% to 8%. Mites were found on the following fruit tree species: *Malus domestica* BORKH. - 66 mite species, *Armeniaca vulgaris* LAM. - 24, *Cydonia oblonga* MILL. - 25, *Pyrus communis* L. - 11, *Prunus domestica* L. - 42, *Cerasus avium* (L.) MOENCH - 32, *Cerasus vulgaris* MILL. - 23, *Prunus divaricata* - 16, *Persica vulgaris* MILL. - 3. During 2006-2010, the list of mite specie was expanded by 32 species.

Keywords: mites, fauna, trophic specialization.

Rezumat. Acarienii plantaţiilor de pomi fructiferi din Republica Moldova. Fauna de acarieni a plantaţiilor pomicole din Republica Moldova constă din 132 specii incluse în 15 familii, colectate în perioada 1995-2010. Au fost înregistrate 87 specii rare de acarieni. Specializarea trofică a acarienilor de plante în termeni de apariţie: speciile de bază - mai mare de 7%, cele sporadice - nu mai mult de 4%, speciile asociate 4-8%. Acarienii au fost găsiţi pe: *Malus domestica* BORKH. - 66 specii, *Armeniaca vulgaris* LAM. - 24, *Cydonia oblonga* MILL. - 25, *Pyrus communis* L. - 11, *Prunus domestica* L. - 42, *Cerasus avium* (L.) MOENCH - 32, *Cerasus vulgaris* MILL. - 23, *Prunus divaricata* - 16, *Persica vulgaris* MILL. - 3. În perioada 2006-2010 lista acarienilor de plante a fost completată cu 32 de specii.

Cuvinte cheie: acarieni, faună, specializarea trofică.

INTRODUCTION

At present, the variety of fruit plantations of the Republic of Moldova allow to expand the volume of exported fruits. The study of fauna and of trophic relationships of plant mites makes possible to foreseen the changes in the composition of the dominant species of phytophagous mites. Studies on the development of the population density of phytophagous mites can be proposed for plant protection to be included in preventive measures and fight against pests. The most important pests of fruit gardens are the mites of the family Tetranychidae DONNADIEU, 1975 and Eriophyidae NALEPA, 1898.

By sucking the cell sap from the leaves, the mites in mass outbreaks cause the disturbance of photosynthesis, browning and decrease in size of leaves, premature defoliation.

The species of the family Tetranychidae (Fig. 1) create necrotic spots on leaves and those of Eriophyidae create structures in the form of convex balls (galls). At present, the density of the populations of previously less important species of phytophagous mites from the family Eriophyidae (Fig. 2) increased to economically meaningful values. When the number of mites on a piece of leaf reaches 41 individuals the fruit quality is low.

The main regulators of phytophagous mite's abundance are individuals from the family Phytoseiidae BERLESE, 1916. It was established that the development of the populations of phytophagous mites is affected by temperature and humidity.

The studies of fruit plantations during 2006-2010 expanded the list of mites by 32 species. Some species of mites have been recorded as rare and occur only in fruit plantations.

MATERIAL AND METODS

Plant mites were collected in fruit plantations from three geographical zones (Northern Moldavian Plateau, Central and Southern Moldavian Plateau) of the Republic of Moldova in 65 villages between 1995 and 2010 as it follows: Durleşti, Băcioi, Străşeni, Codru, Vadul lui Vodă, Budeşti, Elizavetovca, Ţaul, Coşniţa, Brătuşeni, Sadovoe, Cricova, Ghidighici, Grătieşti, Stăuceni, Mereni, Tohatin, Grătieşti, Albiniţa, Cotiujeni, Corjeuţi, Lărguţa, Călăraşi, Bahmut, Sadova, Ţibirica, Căinari, Bălăbăneşti, Bălţata, Boşcana, Cimişeni, Cruglic, Dubăsarii Vechi, Maşcăuţi, Oniţcani, Lopatnic, Brînzeni, Ialoveni, Naslavcea, Berezlogi, Făgureni, Dolna, Lozova, Micăuţi, Huzun, Sireţ, Rezina, Floreni, Ivanovca, Ialoveni, Cucoara, Cahul, Zăbriceni, Făureşti, Topcino, Cuculeni, Ţînţărăni, Capriani, Orgeev, Livadeni, Valea Mare, Trifeşti, Cuizăuca, Buşeuca, Rădenii Vechi.

The material includes 147 samples for the period 2006-2010 and 8,390 samples for the period 1995-2005. Thus, it is about industrial gardens with areas from 10 to 3,250 hectares and farms with areas of 5 to 20 hectares, aged 5 to 50 years. 9 species of fruit plants were examined in different gardens located on plains, slopes and hilltops. The location of the gardens was near the forest or adjacent to fields and abandoned lands.

The collection of plant samples was performed by the following methods: 1. on heavily damaged single trees; 2. on the diagonal of the garden from 10 trees by 10 leaves; 3. on sectors of 100 meters length and a distance of 50 and 100 meters from the edge of the garden. Plant samples: shoots of 50 cm length, the first leaves, inflorescences, very young fructifications - 10 shoots of 10 trees each; 100 leaves: 10 leaves of 10 trees each; bark - from 10 trees.

The collection of total preparations of mites is deposited in the Laboratory of Entomology, Institute of Zoology of Moldova. On the preparations there are indicated: no of sample, no of preparation, date of collection, location, plant species, mite species. A database of the species composition of mites was created.

The present, the work on the distribution of mites on different species of fruit plants is original for Moldova.

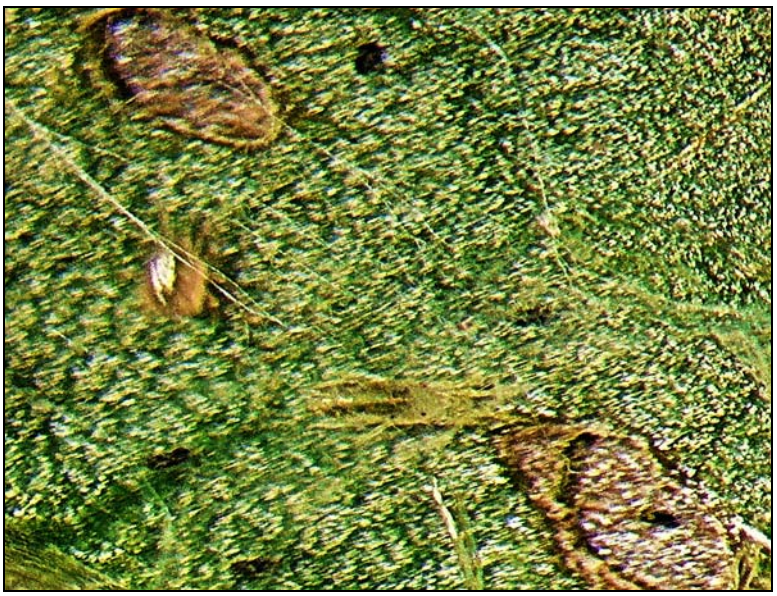

Figure 1. Necrotic spots provoked by *Schizotetranychus* (E.) *fraxini* (Tetranychidae) (original).
Figura 1. Petele de necroză provocate de *Schizotetranychus* (E.) *fraxini* (Tetranychidae) (original).

Figure 2. *Eriophyidae* NALEPA, 1898 (female) (original).
Figura 2. *Eriophyidae* NALEPA, 1898 (femelă) (original).

RESULTS AND DISCUSSIONS

The mite fauna of fruit plantations of the Republic of Moldova consists of 132 species from 15 families belonging to the orders Acariformes ZACH., 1941 and Parasitiformes REUTER, 1909 (Table1).

According to the trophic specialization, the mites are divided in: predators (Phytoseiidae - 24%, Stigmaeidae - 5%, Anystidae - 1%, Cunaxidae - 2%), microphages (Tydeidae - 19%, Pygmephoridae - 2%, Scutacaridae - 1%, Glycyphagidae - 1%, Cryptognathidae - 1%, Tarsonemidae - 10%) and phytophagous (Tenuipalpidae - 5%, Bryobiidae - 8%, Eriophyidae - 5%, Acaridae - 3%, Tetranychidae - 13%) (Fig. 3).

In terms of occurrence of the main composition, we mention the mites above 7%. The group of mites with the index less than 4% was formed by sporadic species. The third group was the related species, whose rate of occurrence varied from 4 to 8%. Among predatory mites the most abundant species were from the families Phytoseiidae - 24% and phytophagous mites from Eriophyidae - 5%, Bryobiidae - 8%, Tetranychidae - 13% (KULIKOVA, 1996, 2002).

Table 1. Mite species of fruit plantations of the Republic of Moldova.
Tabel 1. Speciile de acarieni ai livezilor din Republica Moldova.

Species	*Malus domestica*	*Prunus domestica*	*Pyrus communis*	*Cerasus avium*	*Persica vulgaris*	*Cydonia oblonga*	*Armeniaca vulgaris*	*Cerasus vulgaris*	*Prunus divaricata*
Order Acariformes ZACH., 1941 **Family Tarsonemidae** KRAMER, 1877									
Tarsonemus angulatus			+						
T. bifurcatus							+		
T. crassus	+		+						
T. ellipticus				+					
T. hermes	+								
T. lobus						+			
T. naegelie	+	+		+		+			
T. pauperoseatus			+						
T. piliger		+							
T. talpae	+	+							
T. trapezoides	+			+					
T. virgineus				+					
T. vulgaris		+							
Family Pygmephoridae CROSS, 1965									
Siteroptes crossi	+								
S. *hassi*	+								
Family Scutacaridae OUDEMANS, 1916									
Imparipes puberulus	+								
Family Tydeidae KRAMER, 1877									
Tydeus caudatus		+		+				+	+
T. californicus	+		+	+	+	+	+	+	
T. devexus						+			
T. dignus		+							
T. elinguis									+
T. heterosetus		+							+
T. kochi				+					
T. mirabilis							+		
T. obstinatus	+								
T. praefatus							+		
T. wainsteini	+	+							+
Paralorryia ferula	+								
P. lena							+		
P. mali	+	+							
P. ocellata	+								
P. opifera						+			
P. subularis				+					
P. woolleyi						+			
Tydides ulter	+								
Triophtydeus immanis		+		+		+	+		
T. flatus	+	+				+			+
Lorryia reticulata	+			+					
Pronematus anconai		+						+	
P. rapidus							+		
P. sextoni	+	+					+		
Pronematulus oblongus		+							
Family Cunaxidae THOR, 1902									
Cunaxoides parvus		+							
C. ulcerosus						+			
Cunaxoides sp.	+								
Family Stigmaeidae OUDEMANS, 1931									
Eustigmaeus pinnata							+		
E. rhodomela				+					
Mediolata pini				+					
Stigmaeus longipilis				+					
Zetzellia mali	+	+				+			
Villersiella sp.	+								
Family Anystidae OUDEMANS, 1902									
Anystis baccarum	+								
Family Tetranychidae DONNADIEU, 1975									
Panonychus citri						+			
P. ulmi	+		+			+			
Schizotetranychus pomeranzevi	+	+							
S. prunicola	+	+						+	
S. fraxini	+	+	+	+	+	+	+	+	
S. rajae	+								

S. orientalis	+			+				+	+
S. uchidai	+								
S. populi	+								
Amphitetranychus viennensis		+		+				+	
Tetranychus lonicerae	+								
T. urticae		+							
T. pamiricus	+					+			
T. polygoni	+								
T. sawzdargi	+								
Metatetranychoides longiclavatus	+								
Polynychus rubicundus	+	+				+	+		
P. przhevalskii	+						+		
Family Bryobiidae BERLESE, 1913									
Bryobia (Lyobia) ribis	+			+					
B. lonicerae	+	+		+				+	
B. ulmophila		+						+	
B. redicorzevi		+	+	+		+	+	+	+
B. angustisetis	+							+	+
B (L) confusa								+	
B. (B.) graminum	+			+				+	
B. lagodechiana								+	
B. vasiljevi								+	
B. tiliae							+		
Family Tenuipalpidae BERLESE, 1913									
Cenopalpus (C.) mespili	+						+		
C. piger	+		+	+					
C. pennatisetis	+			+		+			
C. pulcher	+	+		+					
C. ruber	+								
C. populi	+			+					
Amblypalpus narsikulovi				+					
Family Eriophyidae NALEPA, 1898									
Eriophyes angro	+								
E. cochi	+	+							
E. mali	+								
E. pyri	+								
E. similis	+								
Aculus schlechtendali	+	+				+			
Family Acaridae LEACH, 1816									
Acarus tyrophagoides	+								
Acotyledon agilis			+				+		
A. rhizoglyphoides	+		+			+		+	
A. redikorzevi	+			+		+	+		
Family Glycyphagidae BERLESE, 1923									
Glycyphagus ornatus								+	
Erythraeus sp.							+		
Order Parazitiformes REUTER, 1909 **Family Phytoseiidae** BERLESE, 1916									
Amblyseius andersoni		+						+	
A. agrestis								+	
A. astutus									+
A. finlandicus	+	+	+	+	+	+	+	+	+
A. graminis						+			
A. herbarius	+								
A. marginatus	+								
A. meridionalis							+		
A. meghriensis							+		
A. rademacheri							+		
A. reductus		+				+			
A. umbraticus		+							
Typhloctonus formosus		+							
T. sguamiger		+							
Typhlodromus cotoneastri		+		+			+		
T. pyri		+							+
T. tiliarum									+
Anthoseius caudiglans							+		
A. inopinatus								+	
A. rhenanus				+					
A. recki	+								
Kampimodromus aberrans	+	+		+		+			+
K. langei	+	+				+			

K. marzhaniani								+	
Phytoseius echinus	+	+		+					
P. juvenis		+							
Phytoseius corniger	+	+							
P. plumifer	+								
P. hera	+								
P. salicis				+					
Paraseiulus soleiger									+
Paraseiulus subsoleiger								+	
Metaseiulus longipilis		+					+		

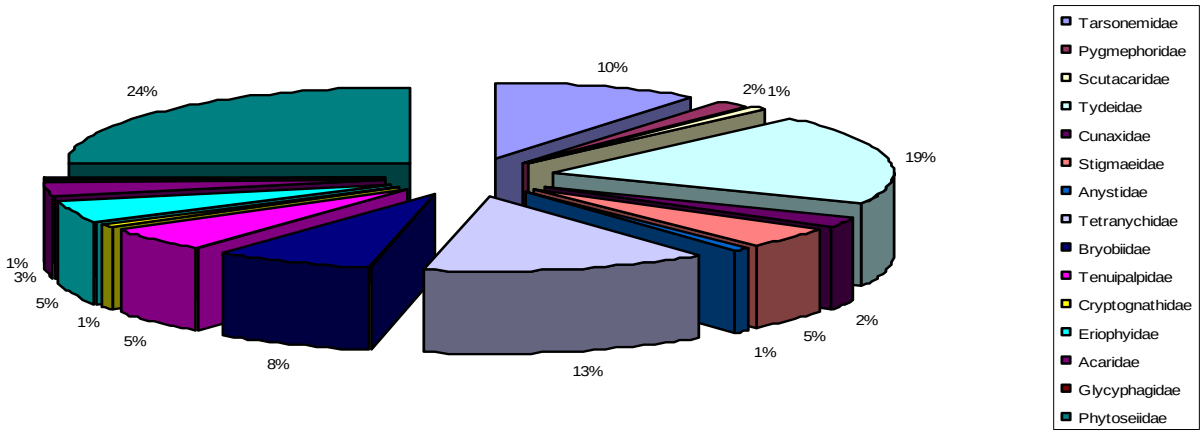

Figure 3. Trophic specialization of the mites of fruit plantations.
Figura 3. Specializarea trofică a acarienilor plantațiilor fructifere.

The study of trophic relationships offers the possibility to foreseen the changes in the composition of dominant species of phytophagous mites and the development of their population density.

In apple fruit plantations economically important species of phytophagous mites were identified: *Eriophyes angro, E. cochi, Aculus schlechtendali*, *Schizotetranychus (E.) fraxini, S. pomeranzevi, S. prunicola, Panonychus citri, P. ulmi, Amphitetranychus viennensis, Tetranychus urticae*. Most effective in combating phytophagous mites are predatory mites *Amblyseius andersoni, A. finlandicus, Typhloctonus formosus*, *Typhlodromus cotoneastri, T. pyri*, *Anthoseius rhenanus*, *Kampimodromus aberrans*, *Phytoseius juvenis*, *P. echinus* (KULICOVA, 1997, 2000, 2000a, 2007, 2007a).

The factors influencing the diversity of fruit plantation mites are: plant species, age, soil properties, air temperature and humidity. We further render the trophic specialization of mites on 9 species of fruit plants:

Malus domestica BORKH. - Tarsonemidae 8%, Tydeidae 14%, Cunaxidae 2%, Stigmaeidae 3%, Bryobiidae 6%, Tenuipalpidae 9%, Acaridae 5%, Phytoseiidae 15%, Eriophyidae 9%, Pygmephoridae 2%, Scutacaridae 2%, Tetranychidae 22%, Anystidae 2% (Fig. 4).

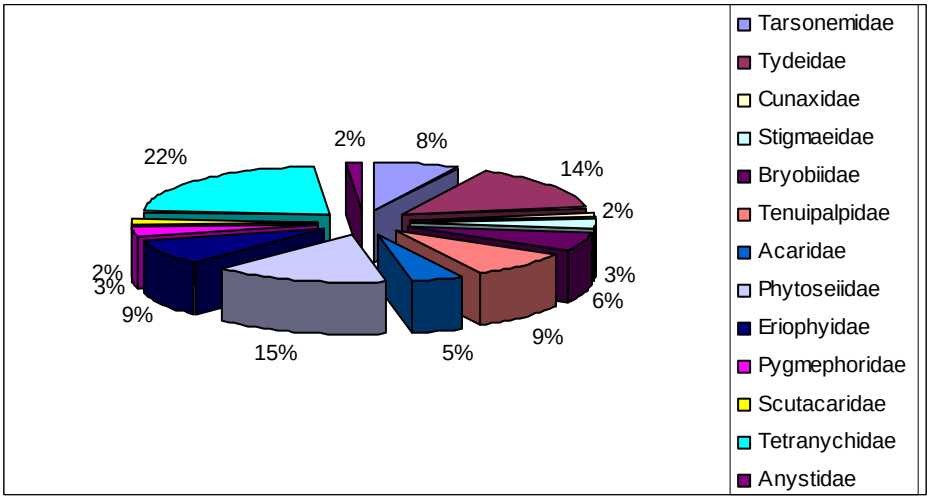

Figure 4. Mites of *Malus domestica* fruit plantations.
Figura 4. Acarienii plantațiilor fructifere de *Malus domestica*.

Armeniaca vulgaris LAM. - Tarsonemidae 4%, Tydeidae 30%, Stigmaeidae 4%, Bryobiidae 8%, Tenuipalpidae 4%, Acaridae 8%, Glycyphagidae, Phytoseiidae 29%, Tetranychidae 13% (Fig. 5).

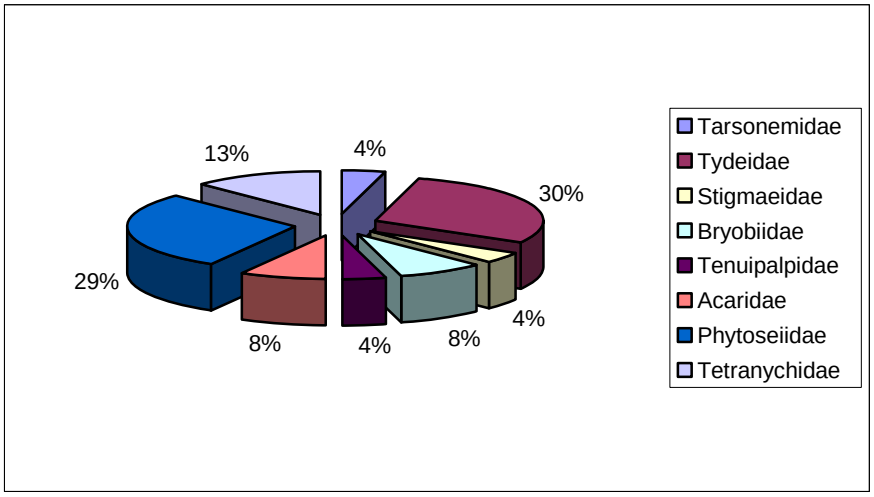

Figure 5. Mites of *Armeniaca vulgaris* fruit plantations.
Figura 5. Acarienii plantațiilor fructifere de *Armeniaca vulgaris*.

Cydonia oblonga MILL. - Tarsonemidae 8%, Tydeidae 26%, Cunaxidae 4%, Stigmaeidae 4%, Bryobiidae 4%, Tenuipalpidae 4%, Acaridae 4%, Phytoseiidae 21%, Eriophyidae 4%, Tetranychidae 21% (Fig. 6).

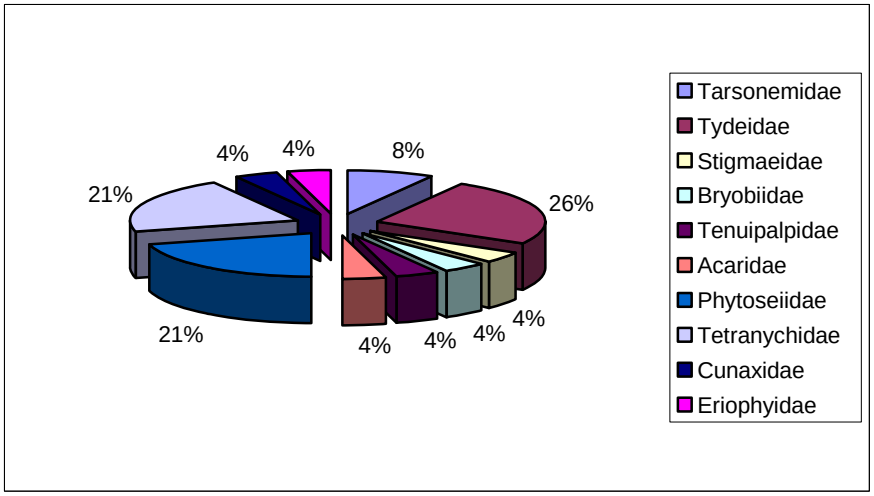

Figure 6. Mites of *Cydonia oblonga* fruit plantations.
Figura 6. Acarienii plantațiilor fructifere de *Cydonia oblonga*.

Pyrus communis L. - Tarsonemidae 28%, Tydeidae 18%, Bryobiidae 9%, Tenuipalpidae 9%, Acaridae 9%, Phytoseiidae 9%, Tetranychidae 18% (Fig. 7).

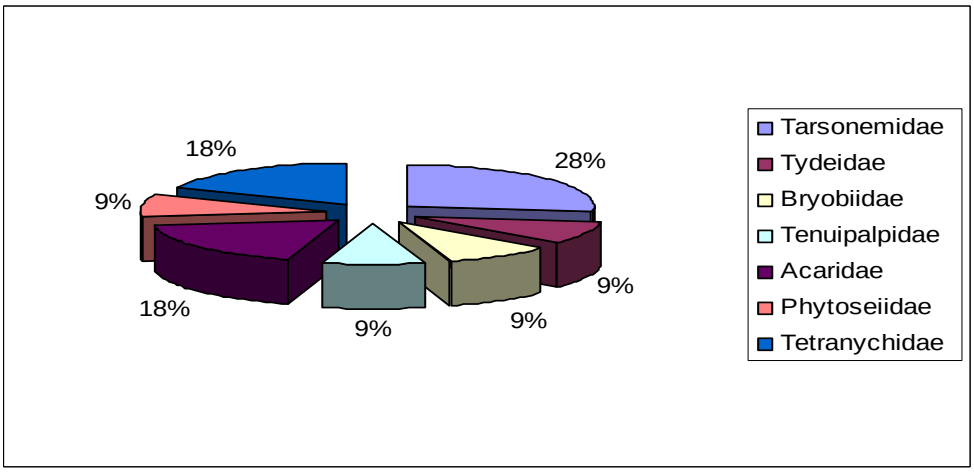

Figure 7. Mites of *Pyrus communis* fruit plantations.
Figura 7. Acarienii plantațiilor fructifere de *Pyrus communis*.

Prunus domestica L. - Tarsonemidae 10%, Tydeidae 24%, Bryobiidae 7%, Tenuipalpidae 2%, Acaridae 9%, Phytoseiidae 34%, Tetranychidae 14%, Cunaxidae 2%, Stigmaeidae 2%, Eriophyidae 5% (Fig. 8).

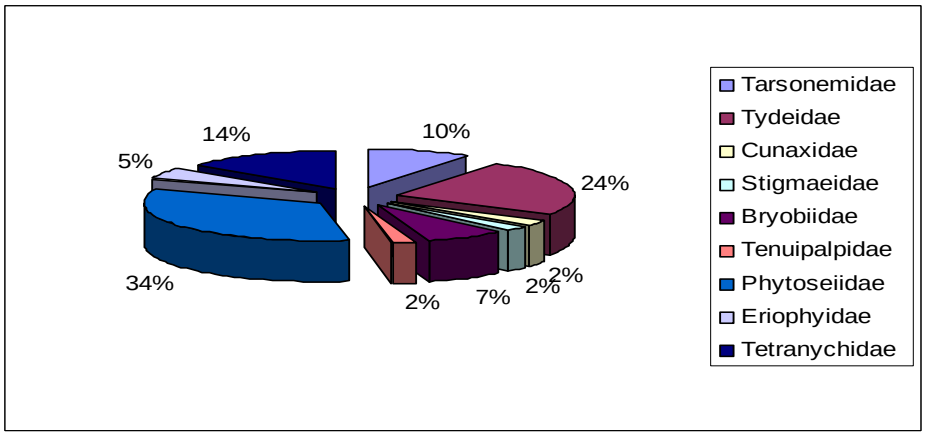

Figure 8. Mites of *Prunus domestica* fruit plantations.
Figura 8. Acarienii plantaţiilor fructifere de *Prunus domestica*.

Cerasus avium (L.) MOENCH. - Tarsonemidae 13%, Tydeidae 18%, Stigmaeidae 9%, Bryobiidae 13%, Tenuipalpidae 16%, Acaridae 3%, Phytoseiidae 19%, Tetranychidae 9% (Fig. 9).

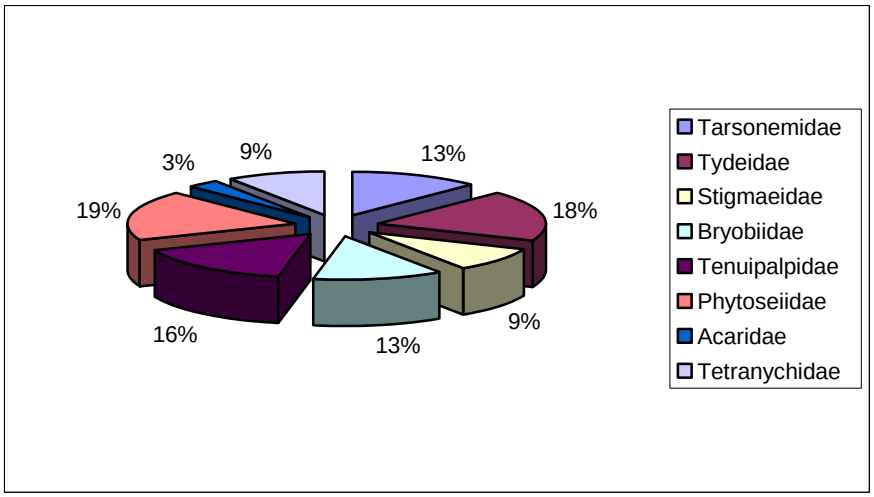

Figure 9. Mites of *Cerasus avium* fruit plantations.
Figura 9. Acarienii plantaţiilor fructifere de *Cerasus avium.*

Cerasus vulgaris MILL**. -** Tarsonemidae 8%, Tydeidae 13%, Bryobiidae 36%, Tenuipalpidae 9%, Acaridae 4%, Phytoseiidae 26%, Tetranychidae 17%, Glycyphagidae 4% (Fig. 10).

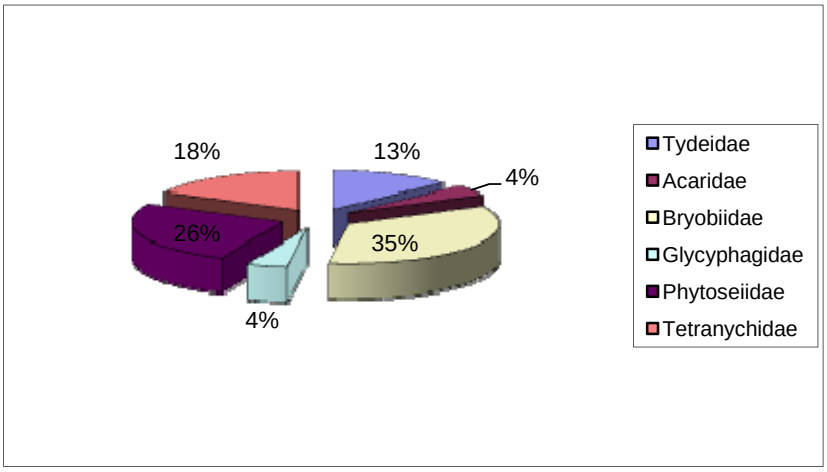

Figure 10. Mites of *Cerasus vulgaris* fruit plantations.
Figura 10. Acarienii plantaţiilor fructifere de *Cerasus vulgaris*.

In fruit plantations the association of certain mite species to certain fruit tree species was detected. For the first time, the list of rare species of mites was compiled - 87 species, which reflects the current state of knowledge and the distribution of each species. We have also introduced species represented by single individuals in the list.

In seed fruit orchards 42 species of mites were found:

- ***Malus domestica*** BORKH.: *Tarsonemus hermes, Tydeus obstinatus, Paralorryia ferula, P. ocellata, Tydides ulter, Cunaxoides* sp., *Villersiella* sp., *Bryobia ribis, Cenopalpus mespili, C. ruber, Acarus tyrophagoides, Amblyseius herbarius, A. marginatus, Anthoseius recki, Phytoseius corniger, P. plumifer, P. hera, Eriophyes mali, E. angro, E. pyri, E. similis, Siteroptes crossi, S. hassi, Imparipes puberulus, Schizotetranychus (E.) uchidai, S. rajae, S. populi, Metatetranychoides longiclavatus, Tetranychus lonicerae, T. pamiricus, T. polygoni, T. sawzdargi, Anystis baccarum;*

- ***Pyrus communis*** L.: *Tarsonemus angulatus, T. pauperoseatus;*

- ***Cydonia oblonga*** MILL.: *Tarsonemus lobus, Tydeus devexus, Paralorryia opifera, P. woolleyi, Cunaxoides ulcerosus, Amblyseius graminis, Panonychus citri.*

In stone fruit gardens 45 species of mites were registered:

- ***Cerasus avium*** (L.) MOENCH: *Tarsonemus ellipticus, Tydeus kochi, Paralorryia subularis, Amblypalpus narsikulovi, Eustigmaeus rhodomela, Stigmaeus longipilis, Mediolata pini, Typhlodromus cotoneastri, Phytoseius salicis;*

- ***Armeniaca vulgaris*** LAM.: *Tarsonemus bifurcatus, Tydeus mirabilis, T. praefatus*, *Paralorryia lena*, *Pronematus rapidus, Eustigmaeus pinnata, Bryobia* (L.) *tiliae, Cenopalpus mespili, Erythraeus* sp., *Amblyseius rademacheri, A. meridionalis, A. meghriestis, Anthoseius caudiglans, Metaseiulus longipilis*, *Polynychus rubicundus;*

- ***Cerasus vulgaris*** MILL.: *Amblyseius agrestis, Anthoseius inopinatus, Kampimodromus marzhaniani*, *Paraseiulus subsoleiger, Glycyphagus ornatus, Bryobia* (L.) *lagodechiana, B. vasiljevi, B* (L) *confusa;*

- ***Prunus domestica*** L.: *Tarsonemus piliger, T. vulgaris, Pronematulus oblongus, Tydeus dignus, Cunaxoides parvus, Typhloctonus formosus, T. sguamiger*, *Phytoseius juvenis*, *Metaseiulus longipilis, Phytoseius corniger*;

- ***Prunus divaricata*** LEDEB.: *Amblyseius astutus, Typhlodromus tiliae, Tydeus elinguis.*

The study of mite fauna in fruit plantations should continue in order to provide fruit producing enterprises forecasts (short and long term) of the possible damages produced by phytophagous mites.

CONCLUSIONS

Mite fauna of fruit plantations of the Republic of Moldova consists of 132 species: at *Malus domestica* (66), *Armeniaca vulgaris* (24), *Cydonia oblonga* (25), *Pyrus communis* (11), *Prunus domestica* (42), *Cerasus avium* (32), *Cerasus vulgaris* (23), *Prunus divaricata* (16), *Persica vulgaris* (3).

In apple fruit plantations, the dominant species of phytophagous mites are *Eriophyes angro, E. cochi, Aculus schlechtendali*, *Schizotetranychus (E.) fraxini, S. pomeranzevi, S. prunicola, Panonychus citri, P. ulmi, Amphitetranychus viennensis, Tetranychus urticae*. The dominant predatory mite species are *Amblyseius andersoni, A. finlandicus, Typhloctonus formosus*, *T. cotoneastri, T. pyri*, *Anthoseius rhenanus*, *Kampimodromus aberrans*, *Phytoseius juvenis*, *P. echinus.*

Rare species of mites were found in fruit plantations: in seed fruit ones – 42, in stone fruit ones – 45.

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