Vestnik zoologii, **43**(3): 245–252, 2009

UDC 595.422(477)

PHYTOSEIID MITES (PARASITIFORMES, PHYTOSEIIDAE) ON PLANTS IN TROSTYANETS DENDROLOGICAL PARK (UKRAINE)

I. D. Omeri

Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine,
B. Chmielnicky str., 15, Kyiv, 01601 Ukraine
E-mail: scherina@rambler.ru

Accepted 22 December 2008

Phytoseiid Mites (Parasitiformes, Phytoseiidae) on Piants in Trostyanets Dendrological Park (Ukraine). Omeri I. D. — Species composition and distribution of phytoseiid mites (Parasitiformes, Phytoseiidae) are studied studied on plants in Trostyanets state dendrological park NAS of Ukraine (Trostyanets village, Ichnya region, Chernigiv oblast, Ukraine) for the first time. Mites of twenty phytoseiid species from nine genera were found. Frequency of occurrence of each species is estimated as well as their relative biotopic allocation to both vegetation type and plant species.

Key words: phytoseiid mites, frequency of occurrence, relative biotopic allocation, Trostyanets state dendrological park NAS of Ukraine, forest-steppe, Ukraine.

Клещи-фитосейиды (Parasitiformes, Phytoseiidae) на растениях дендрологического парка «Тростянец» (Украина). Омери И. Д. — Впервые установлен видовой состав и распределение клещей-фитосейид (Parasitiformes, Phytoseiidae) на растениях Государственного дендрологического парка «Тростянец» НАН Украины (с. Тростянец, Ичнянский р-н, Черниговская обл., Украина). Выявлены 20 видов 9 родов семейства, рассчитаны встречаемость и относительная биотопическая приуроченность каждого зарегистрированного вида клеща к типам растительности и видам растений.

Ключевые слова: клещи-фитосейиды, встречаемость, относительная биотопическая приуроченность, Государственный дендрологический парк «Тростянец» НАН Украины, Лесостепь, Украина.

Introduction

Recently, new direction in researches of free-living mites from family Phytoseiidae associated with studying pressure of human economical activity on species and specific mite complexes living in artificial cenoses was established. Due to increased anthropogenic load, role of dendrological parks and botanical gardens in preserving specific variety of these plant-inhabiting mites rises. Studies on predatory phytoseiid mites in such cenoses are actual both in theoretical and practical aspects.

However, there are few references on intentional researches of plant-inhabiting mites from family Phytoseiidae in dendrological parks and botanical gardens in Ukraine. Colonization of woody plants by phytophagous mites were studied in botanical garden of Uzhgorod university only (Kruglikov, 1987). Also, such researches were carried out when specific composition of zoophagous arthropods feeding on fruit pests was established in Krasnokutsk dendrological park, and phytoseiid mites were also studied (Storozheva et al., 1993).

In European literature, there are disembodied data on gamasid mites including phytoseiids inside and on plants in Polish national natural parks (Gwiazdowicz, Szadkowski, 2000; Skorupski, 2001; Gwiazdowicz, Klemt, 2004). Information on phytoseiid species from Gauja National park (Latvia) was presented in review on mites from this family (Salmane, Petrova, 2002).

Since 2004, we have been carrying out complex researches on specific composition of phytoseiid mites in dendrological parks in the forest-steppe zone of Ukraine. For the first time we studied complex of plant-inhabiting phytoseiid mites in Oleksandriya state dendrological park NAS of Ukraine (Bila Tserkva town, Kyiv oblast) (Omeri, Kolodochka, 2004 (2005)). Specific composition and ecology of mites from family Phytoseiidae

lived on plants in some botanical gardens in Kyiv (Akimov et al., 2007), and on plants in Kremenets botanical garden were studied (Kremenets town, Ternopol oblast) (Omeri, 2007).

Material and methods

We examined our own collections of phytoseiid mites from plants in Trostyanets dendrological park (Trostyanets village, Ichnya region, Chernigiv oblast, Ukraine). Totally, 831 mites from 137 samples collected from 110 species of wood-shrub plants and 1 species of herbaceous plants. Samples were taken from plants by standard techniques: shaking off on black paper (Kuznetsov, Petrov, 1984) and by direct collection under binocular microscope MBS-1 (Kolodochka, 1978). Sampling was made on the whole territory of dendrological park so that estimation of plant colonization was objective. Microslides were made by mounting mites in For-Berleze liquid (Kolodochka, 1978). Characteristics of specific mite complexes were studied with using Paliy-Kovnatski domination index (DI) and frequency index (I_s) (Schitikov et al., 2003). Belonging of phytoseiid species to certain ecological groups of mites was determined by their affinity to some type of habitat (Kolodochka, 2000) with using of calculated value of their relative biotopic allocation (F) (Pesenko, 1982).

Results and discussion

Collected mites from family Phytoseiidae were identified as 20 species from 9 genera. Phytoseiid mites revealed in Trostyanets dendrological park live on different plant species.

Amblyseius andersoni Chant, 1957 was found on common barberry (*Berberis vulgaris* L.), Maximowicz fir (*Picea maximowiczii* Reg.), Chinese juniper (*Juniperus chinensis* L.), common juniper (*Juniperus communis* L.), Circassian walnut (*Juglans regia* L.), Rocky Mountain Douglas-fir (*Pseudotsuga glauca* Mayer.), polyantha rose (*Rosa multiflora* Thunb.), European box (*Buxus semperwirens* L.), yellow pine (*Pinus ponderosa* Dougl.), white cedar (*Thuja occidentalis* L.), dwarf apple (*Malus baccata* (L.) Borkh.).

Amblyseius maior Karg, 1970 was found on black alder (*Alnus glutinosa* (L.) Goertn.).

Amblyseius rademacheri Dosse, 1958 was registered on tara vine (*Actinidia arguta* Sieb. et Zucc.), red elder (*Sambucus racemosa* L.), sawara tree (*Chamaecyparis pisifera* Sieb. et Zucc.), Italian clematis (*Clematis viticella* L.), beauty bush (*Kolkwitzia amabilis* Graebn.), Chinese mulberry (*Cudrania tricuspidata* (Carr.) Bur. ex Lav.), tree peony (*Paeonia suffruticosa* Andr.), scarlet firethorn (*Pyrocantha coecinea* Roem.), false spirea (*Sorbaria arborea* C. K.), bridewort spiraea (*Spiraea salicifolia* L.).

Neoseiulus reductus Wainstein, 1962 lives on red elder, Italian clematis.

Euseius finlandicus Oudemans, 1915 was seen on tara vine, common cherry-plum (*Prunus divaricata* Lebed.), aralia manshurica (*Aralia manshurica* Rupr. et Maxim.), common barberry (*Berberis vulgaris f. atropurpurea* Regel.), Amur cork tree (*Phellodendron amurense* Rupr.), warty euonymus (*Euonymus verrucosa* Scop.), hawthorn longthorn (*Crataegus macrocantha* Lodd.), common elder (*Sambucus nigra* L.), European beech (*Fagus sylvatica* L.), Kentucky mahogany (*Gymnocladus dioicus* (L.) Koch.), European white elm (*Ulmus laevis* Pall.), Scotch elm (*Ulmus scabra* Mill.), hydrangea bretschneideri (*Hydrangea bretschneideri* Dipp.), horse-chestnut (*Aesculus hippocastanum* L.), European hornbeam (*Carpinus betulus* L.), chestnut-leaved oak (*Quercus castaneifolia* C. A. Mey), English oak (*Quercus robur* L.), lonicera ruprechtiana (*Lonicera ruprechtiana* Regel.), purging buckthorn (*Rhamnus cathartica* L.), southern catalpa (*Catalpa bignonioides* Walt.), hedge cotoneaster (*Cotoneaster lucidus* Schlecht.), sawara tree, yellowwood (*Cladrastis lutea* (Michx.) Koch.), Norway maple (*Acer platanoides* L.), common maple (*Acer campestre* L.), Tatarian maple (*Acer tataricum* L.), maple ash (*Acer negundo* L.), European hazel (*Corylus avellana* L.), American basswood (*Tilia americana* L.), tillet (*Tilia cordata* Mill.), European basswood (*Tilia europaea* L.), lime tree (*Liriodendron tulipifera* L.), magnolia kobus (*Magnolia kobus* DC.), trailing mahonia (*Mahonia aquifolium* Nutt.), osage orange (*Maclura aurantica* Nutt.), black alder, European walnut, butternut (*Juglans cinerea* L.), black walnut (*Juglans nigra* L.), tree peony, quinine tree (*Ptelea trifoliate* L.), robinia (*Robinia pseudoacacia* L.), wild service tree (*Sorbus torminalis* L.),

mountain ash (*Sorbus aucuparia* L.), black chokeberry (*Aronia melanocarpa* (Michx.) Elliot.), false spirea, securinega suffruticosa (*Securinega suffruticosa* (Pall.) Rehd.), golden currant (*Ribes aureum* Pursh.), Japanese pagoda tree (*Sophora japonica* L.), staghorn sumac (*Rhus typhina* L.), blackthorn (*Prunus spinosa* L.), common yew (*Taxus baccata* L.), Amur privet (*Ligustrina amurensis* Rupr.), white cedar, weeping forsythia (*Forsythia suspensa* (Thunb.) Vahl), bird cherry (*Padus avium* Mill.), sweet mockorange (*Philadelphus coronarius* L.), black mulberry (*Morus nigra* L.), pearl bush (*Exochorda albertii* Regel.).

Kampimodromus aberrans Oudemans, 1930 was found on quince tree (*Cydonia oblonga* Mill.), Emerson's thorn (*Crataegus submollis* Sarg.), Caucasian oak (*Quercus macranthera* Fisch. et Mey. ex Hohen.), common catalpa, maple ash.

Kampimodromus corylosus Kolodochka, 2003 was found on European hazel.

Dubininellus echinus Wainstein et Arutunjan, 1970 was registered on red maple (Acer *rubrum* L.), mountain ash, black chokeberry, dwarf apple.

Typhlodromus cotoneastri Wainstein, 1961 was discovered on hawthorn soft, white cedar, dwarf apple.

Typhlodromus ernesti Ragusa et Swirski, 1978 was noticed on Jezo spruce (*Picea jezoensis* Carr.), Colorado spruce (*Picea pungens* Engelm.), whitewood (*Picea abies* (L.) Karst.), black spruce (*Picea mariana* (Mill.) BSP.), common hemlock (*Tsuga canadensis* (L.) Carr.), white cedar.

Typhlodromus laurae Arutunjan, 1974 lives on chestnut-leaved oak, English oak, Alcock spruce (*Picea alcockiana* Carr.), Serbian spruce (*Picea omorica* (Panc.) Purkyne), red spruce (*Picea rubra* Link.), whitewood, Engelmann spruce (*Picea engelmanni* Engelm.), balsam fir (*Abies balsamea* Mill.), Nordmann fir (*Abies nordmanniana* (Stev.) Spach.), needle fir (*Abies holophylla* Maxim.), mountain pine (*Pinus montana* Mill.), yellow pine, cembra pine (*Pinus cembra* L.), Korean pine (*Pinus koraiensis* Sieb. et Zucc.), Crimean pine (*Pinus pallasiana* (Lamb.) D. Don).

Typhlodromus rodovae Wainstein et Arutunjan, 1968 was found on red spruce, needle fir, dwarf apple.

Typhloctonus aceri Collyer, 1957 — on creeping juniper (*Juniperus sabina* L.).

Typhloctonus tiliarum Oudemans, 1930 was registered on dwarf apple only.

Paraseiulus incognitus Wainstein et Arutunjan, 1967 was noticed on northern oak (*Quercus borealis* Michx.).

Amblydromella (s. str.) *halinae* Wainstein et Kolodochka, 1974 lives on quince tree, common cherry-plum, common barberry, black locust (*Gleditschia triacanthos* L.), blackthorn.

Amblydromella inopinata Wainstein, 1975 inhabits Eastern white pine (*Pinus strobus strobus* L.).

Amblydromella (s. str.) *rhenana* Oudemans, 1905 was seen on common barberry, Kentucky mahogany, mealy tree (*Viburnum lantana* L.), few-flowered cotoneaster (*Cotoneaster nitens* Rehd. et Wils.), trailing mahonia, wig-tree (*Cotinus coggygria* Scop.).

Amblydromella clavata Wainstein, 1972 lives on quince tree, common barberry, lonicera ruprechtiana, Oregon cedar (*Chamaecyparis lawsoniana* (Murray) Parl.), sawara tree, Japanese cedar (*Cryptomeria japonica* D. Don.), creeping juniper, Chinese juniper, common juniper, everlasting thorn, noble fir (*Abies alba* Mill.), Siberian fir (*Abies sibirica* Ledeb.), needle fir, Rocky Mountain Douglas-fir, European box, golden currant, Weymouth pine, mountain pine, yellow pine, cembra pine, Korean pine, Archangel fir (*Pinus silvestris* L.), blackthorn, common yew, Amur privet, Western redcedar (*Thuja plicata* D. Don), white cedar, white mulberry (*Morus alba* L.), dwarf apple.

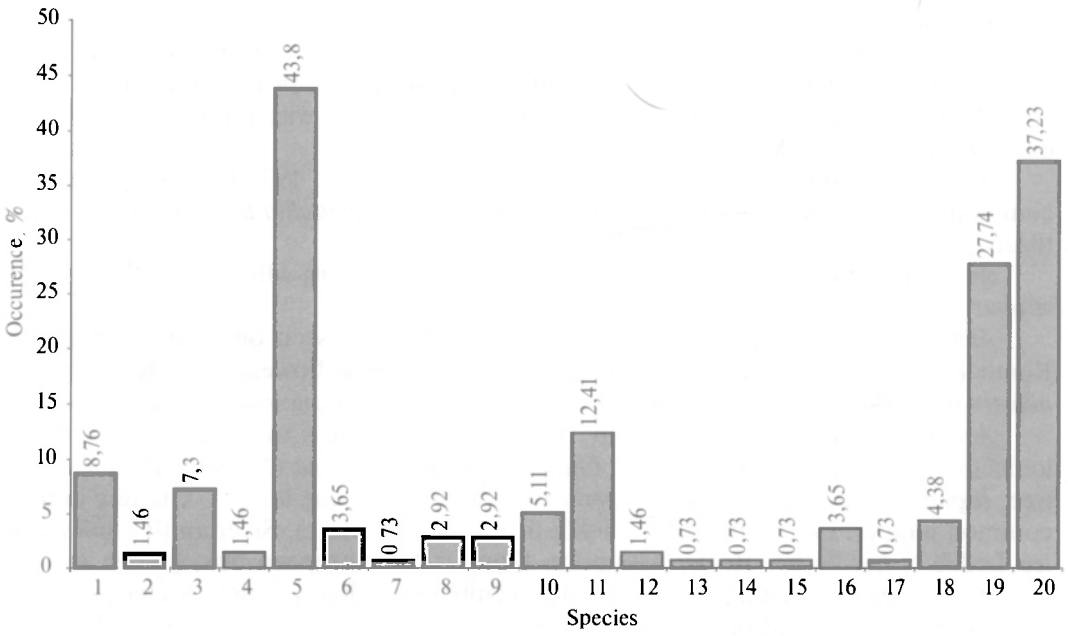
Amblydromella (Aphanoseius) verrucosa Wainstein, 1972 was found on hawthorn longthorn, soft hawthorn, common elder, chestnut-leaved oak, English oak, Alcock spruce, Colorado spruce, Maximowicz fir, spruce fir, black spruce, few-flowered cotoneaster, Oregon cedar, sawara tree, European basswood, common larch (*Larix decidua* Mill.), osage

orange, flowering raspberry (*Rubus odoratum* L.), Chinese juniper, common juniper, black walnut, noble fir, Nordmann fir, Siberian fir, needle fir, ninebark (*Physocarpus opulifolia* (L.) Maxim.), black chokeberry, boxwood evergreen, golden currant, Weymouth pine, mountain pine, yellow pine, cembra pine, Korean pine, Crimean pine, Archangel fir, bridewort spiraea, common yew, Amur privet, common hemlock, Western redcedar, white cedar, witch-hazel (*Hamamelis virginiana* L.), black mulberry, pearl bush.

The share of each mite species in phytoseiid complex of Trostyanets dendrological park was determined by their domination in such complex. In this complex, *E. finlandicus* prevails with domination index 16.0; *A. verrucosa*, *A. clavata*, *T. laurae* are subdominant species with domination indexes 7.48, 4.43, and 1.08, respectively. Subdominants of the first order are three species of phytoseiid mites: *A. andersoni* (Di = 0.36), *A. rademacheri* (Di = 0.28), *T. ernesti* (Di = 0.12). Other species with domination indexes less than 0.1 are secondary species in phytoseiid mites complex.

For each phytoseiid species, frequency indexes for certain plants in Trostyanets dendrological park were calculated (fig. 1). Maximum value were in dominated species *E. finlandicus* (I_s = 43.80%) living on 59 species (53.15%) of plants studied in this dendrological park. Some subdominant species — *A. verrucosa* (I_s = 37.23%), *A. clavata* (I_s = 27.74%), *T. laurae* (I_s = 12.41%) live on 44 (39.63%), 29 species (26.12%) and 15 species of park plants (13.51%), respectively. Subdominants of the first order were found: *A. andersoni* (I_s = 8.76%) on 11 plant species (9.90%), *A. rademacheri* (I_s = 7.30%) on 10 species (9.0%), *T. ernesti* (I_s = 5.11%) on 6 plant species (5.40%). Secondary members of phytoseiid complex in Trostyanets dendrological park inhabit few plants (up to 6 species) and have frequency index less than 5%.

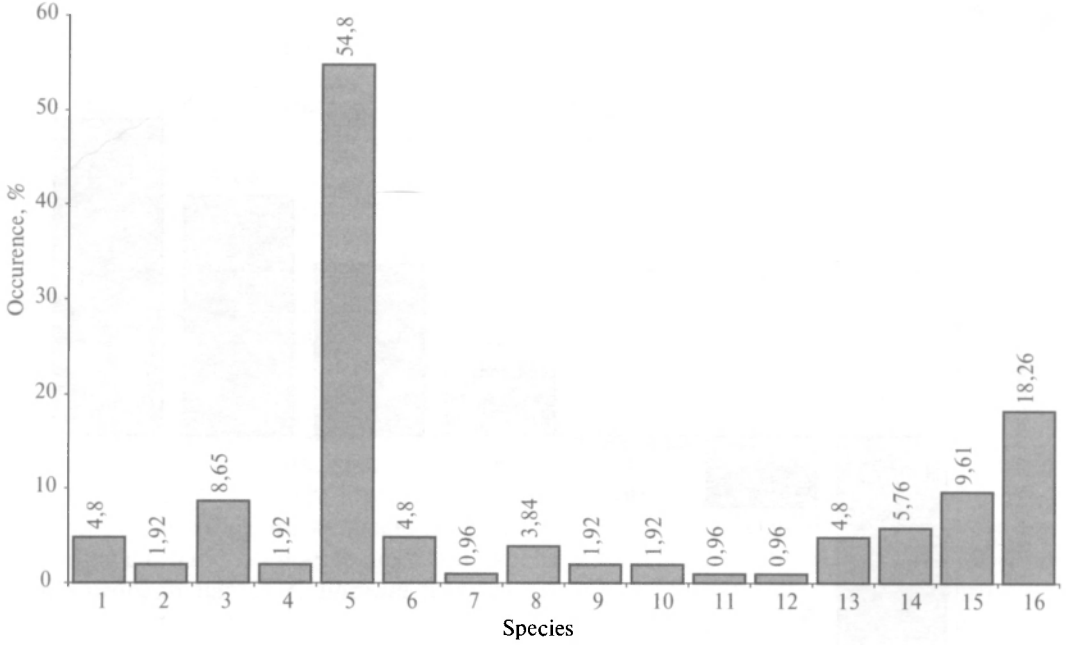
Deciduous plants (70.29% of all plants studied) are inhabited with 16 mite species from 9 genera of family Phytoseiidae (fig. 2). Based on calculated frequency indexes, the most widespread species are *E. finlandicus* (I_s= 54.80%) and *A. verrucosa* (I_s = 18.26%)



1 — *A. andersoni*; 2 — *A. maior*; 3 — *A. rademacheri*; 4 — *N. reductus*; 5 — *E. finlandicus*; 6 — *K. aberrans*; 7 — *K. corylosus*; 8 — *D. echinus*; 9 — *T. cotoneastri*; 10 — *T. ernesti*; 11 — *T. laurae*; 12 — *T. rodovae*; 13 — *T. aceri*; 14 — *T. tiliarum*; 15 — *P. incognitus*; 16 — *A. halinae*; 17 — *A. inopinata*; 18 — *A. rhenana*; 19 — *A. clavata*; 20 — *A. verrucosa*.

Fig. 1. Frequency of phytoseiid mites on plants in Trostyanets dendrological park.

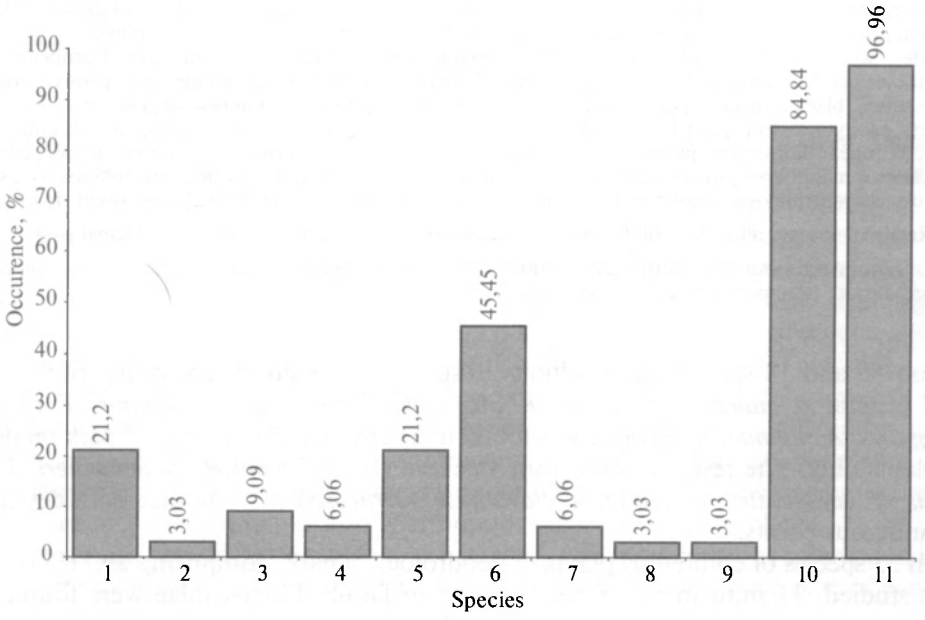
Рис. 1. Встречаемость клещей-фитосейид на растениях дендрологического парка «Тростянец».



1 — *A. andersoni*; 2 — *A. maior*; 3 — *A. rademacheri*; 4 — *N. reductus*; 5 — *E. finlandicus*; 6 — *K. aberrans*; 7 — *K. corylosus*; 8 — *D. echinus*; 9 — *T. cotoneastri*; 10 — *T. laurae*; 11 — *T. tiliarum*; 12 — *P. incognitus*; 13 — *A. halinae*; 14 — *A. rhenana*; 15 — *A. clavata*; 16 — *A. verrucosa*.

Fig. 2. Frequency of phytoseiid mites on deciduous trees in Trostyanets dendrological park.

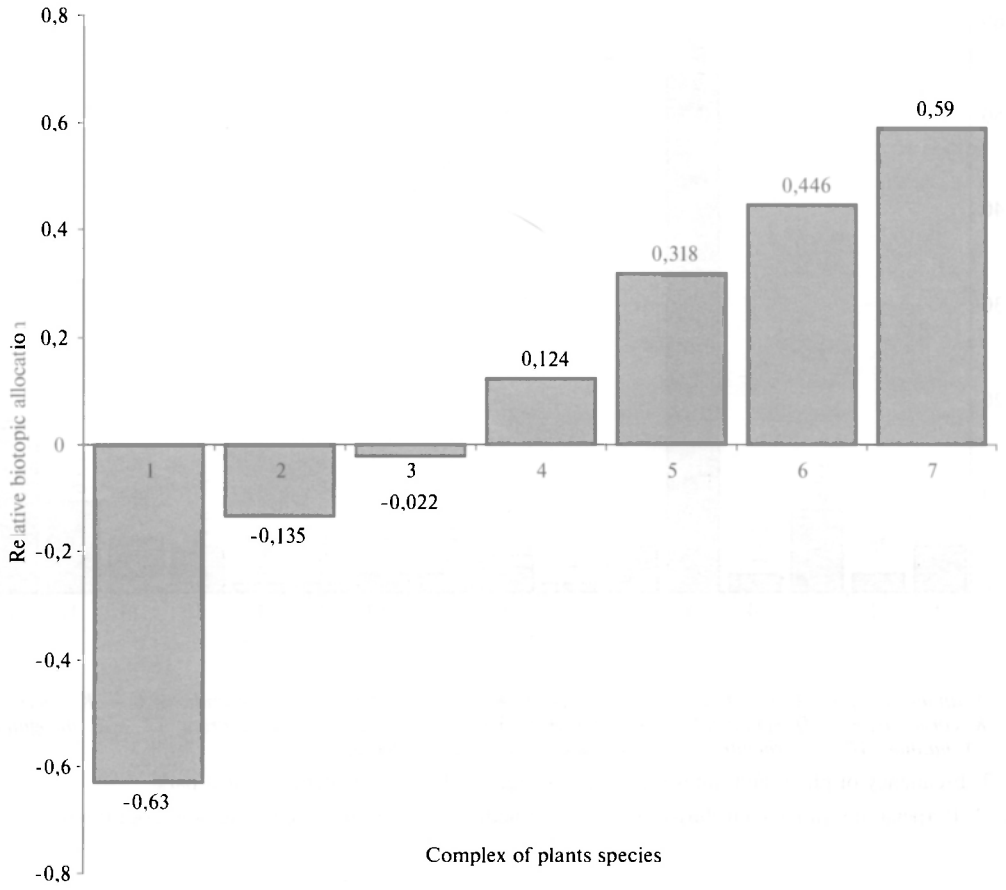
Рис. 2. Встречаемость клещей-фитосейид на лиственных растениях дендропарка «Тростянец».



1 — *A. andersoni*; 2 — *A. rademacheri*; 3 — *E. finlandicus*; 4 — *T. cotoneastri*; 5 — *T. ernesti*; 6 — *T. laurae*; 7 — *T. rodovae*; 8 — *T. aceri*; 9 — *A. inopinata*; 10 — *A. clavata*; 11 — *A. verrucosa*.

Fig. 3. Frequency of phytoseiid mites on conifers in Trostyanets dendrological park.

Рис. 3. Встречаемость клещей-фитосейид на хвойных растениях дендропарка «Тростянец».



1 — white cedar; 2 — common barberry; 3 — sawara tree, blackthorn, common yew; 4 — chestnut-leaved oak, English oak, black chokeberry, golden currant, black alder, Amur privet; 5 — tara vine, hawthorn longthorn, black elder, Kentucky mahogany, lonicera ruprechtiana, southern catalpa, maple ash, European hazel, European basswood, trailing mahonia, osage orange, Circassian walnut, black walnut, tree peony, mountain ash, false spirea, black mulberry, pearl bush; 6 — common cherry-plum; 7 — Chinese angelica tree, Amur cork tree, warty euonymus, European beech, hydrangea bretschneideri, European white elm, Scotch elm, horse-chestnut, European hornbeam, purging buckthorn, hedge cotoneaster, yellowwood, Norway maple, common maple, Tatarian maple, spoonwood, tillet, lime tree, magnolia kobus, butternut, quinine tree, robinia, wild service tree, securinega suffruticosa, scholar-tree, staghorn sumac, weeping forsythia, bird cherry, sweet mockorange.

Fig. 4. Relative biotopic allocation of *Euseius finlandicus* to plants in Trostyanets dendrological park.

Рис. 4. Относительная биотопическая приуроченность вида *Euseius finlandicus* к растениям государственного дендрологического парка «Тростянец».

living on 56 and 18 species of deciduous, respectively. A group consisting of 9 species from 7 genera: *A. maior, N. reductus, K. aberrans, K. corylosus, D. echinus, T. tiliarum, P. incognitus, A. halinae, A. rhenana* was found in Trostyanets dendrological park on deciduous plants only. The rest 7 species from 4 genera (*A. andersoni, A. rademacheri, E. finlandicus, T. cotoneastri, T. laurae, A. clavata, A. verrucosa*) can colonize both deciduous and coniferous plants.

On 33 species of coniferous plants in dendrological park, comprising 29.71% of plant species studied, 11 mite species from 5 genera of family Phytoseiidae were found, and their frequency indexes were calculated (fig. 3). In samples, the most common species was *A. verrucosa* (I_s = 96.96%) inhabiting 26 species (78.80%) of coniferous plants. For two phytoseiid species, *A. clavata* (I_s = 84.84%) and *T. laurae* (I_s = 45.45%), coniferous plants were found to be favorable, because these mites colonized 19 species (57.57%) and 13 species (39.39%) of coniferous plants. The complex of phytoseiid mites living on

coniferous have some character features. *T. ernesti*, *T. rodovae* and *A. inopinata* live on coniferous only making specific acarocomplex. On the contrary, *A. andersoni*, *A. rademacheri*, *E. finlandicus*, *T. cotoneastri* have a low frequency indexes (up to 22%) on coniferous, because they prefer deciduous plants (see above). *T. aceri* was found on coniferous (creeping juniper) occasionally because this species is usual for maple as it is reflected in its name.

For each phytoseiid species revealed in Trostyanets dendrological park, the value of its relative biotopic allocation (F) to the plants where it was found was calculated. Graphic picture of the degree of relative biotopic allocation shows the range of preferences of some mite species to different plant species. For example, *E. finlandicus* (fig. 4) has a wide range of values of its relative biotopic allocation, from minus 0.630 to 0.590, and this is the evidence of low inclination of this mite species to the certain plants. On the contrary, *T. rodovae* is very closely confined to coniferous with degree of its relative biotopic allocation from 0.965 on needle fir to 0.983 on red spruce.

In dendrological park, species of phytoseiid mites with maximum value of biotopic allocation index F = 1 were found out and can be considered as closely confined to particular plant, and they are stenoecic regarding their habitat under conditions of Trostyanets dendrological park. Stenoecic are 5 mite species: *A. maior* from black alder, *K. corylosus* from European hazel, *T. tiliarum* from dwarf apple, *P. incognitus* from northern oak, *A. inopinata* from Weymouth pine. Based on data available (Kolodochka, 1978), in the Forest-steppe of Ukraine, some species from this list were found on the other plants of the same life-form that does their stenoecisity relative in general, is actual for Trostyanets dendrological park only. Of all phytoseiids listed, only *K. corylosus* is true stenoecic because it was found nowhere, except for European hazel.

In most cases, phytoseiid mites can dwell on some species of plants (euryoecic) and have identical degree of relative biotopic allocation. For example, *N. reductus* was found on red elder and Italian clematis and shows the same allocation index (F = 0.982) for both plant species of different vegetation type.

We established that different phytoseiid species can be placed among the following ecological group of mites. The species of phytoseiid mites studied belong to phytobionts. Dendrobionts subgroup (17 species from 8 genera) include mites living in wood-shrub vegetation. In this subgroup, there are some species feeding on leaves (phyllobionts) and met on a bark (corticobionts). The latter here include only 7 species from 3 genera of family Phytoseiidae, namely *A. maior*, *T. ernesti*, *T. laurae*, *T. rodovae*, *A. inopinata*, *A. clavata*, *A. verrucosa*. Herbabionts subgroup is presented by *A. rademacheri*, *N. reductus*, *A. rhenana*. However, *A. rademacheri* is found not only on herbage, but also on red elder, sawara tree, beauty bush, Chinese mulberry, scarlet firethorn, bridewort spiraea. *A. rhenana* inhabits wood-shrub plants only. Herbabionts were had to change their locations for the wood-shrub vegetation likely due to the long-term and regular agrotechnical elimination of perennial herbage on park territory.

Consequently, in Trostyanets dendrological park, rather various complex of phytoseiid mites consisting of 20 species from 9 genera was formed characterized by different degree of relative biotopic allocation and frequency of their occurrence on plants. It provides stable being of vegetable associations without using of chemical pesticides and restrains the number of harmful phytophagous arthopods on levels safe for plants.

This cenosis should be considered as balanced, and it can serve as reservation of specific variety for mites from family Phytoseiidae and be representative part of ecological network of Ukraine.

Akimov I. A., Kolodochka L. A., Zhovnerchuk O. V., Omeri I. D., Samojlova T. P. Species Composition and Ecological Peculiarities of Mites of the Superfamily Tetranychoidea (Acariformes, Trombidiformes) and Family Phytoseiidae (Parasitiformes, Gamasina), Inhabiting Plants in Botanical Gardens of Kyiv (Ukraine). // Vestnik zoologii. — 2007. — **41**, N 6. — P. 521–534. — Russian.

Gwiazdowicz D. J., Klemt J. Mesostigmatic mites (Acari, Gamasida) in selected microhabitats of the Biebrza National Park (NE Poland) // Biol. Lett. — 2004. — **41**, 1. — P. 11–19.

Gwiazdowicz D. J., Szadkowski R. Mites (Acari, Gamasida) of Narew National Park // Fragm. faun. — 2000. — **43**, 8. — P. 91–95.

Kolodochka L. A. Identification key on plant-inhabiting phytoseiid mites. — Kyiv : Nauk. dumka, 1978. — 80 p. — Russian.

Kolodochka L. A. Distribution and ecomorphological groups of mites from family Phytoseiidae (Parasitiformes: Gamasina) of Palaearctic // Izv. Kharkov Entomol. soc. — 2000. — **8**, issue 2. — P. 188–191. — Russian.

Kruglikov S. A. Colonization of woody plants with phytophagous mites under conditions of Botanical garden at the Uzhgorod university // Protection of alien plants from harmful organisms. — Kyiv, 1987. — P. 36–38. — Russian.

Kuznetsov N. N., Petrov V. M. Predatory mites of Baltic region. — Riga : Zinatne, 1984. — 144 p. — Russian.

Omeri I. D. Specific variety and distribution of plant-inhabiting phytoseiid mites (Parasitiformes, Phytoseiidae) in Kremenets botanical garden // Visnik Shevchenko Kyiv University. — 2007. — Issue 15–17. — P. 103–105. — Russian.

Omeri I. D., Kolodochka L. A. Predatory mites from family Phytoseiidae (Parasitiformes, Gamasina) on plants Oleksandriya dendrological park // Izvestiya Kharkiv entomological society. — 2004 (2005) — **12**, issue 1–2. — P. 174–180. — Russian.

Pesenko Yu. A. Principles and methods of quantitative analysis in faunistic studies. — Moscow : Nauka, 1982. — 287 p. — Russian.

Salmane I., Petrova V. Overview on Phytoseiidae Mites (Acari, Mesostigmata, Gamasina) of Latvia // Entomol. Soc. Latvia. — 2002. — **39**. — P. 48–55.

Shitikov V. K., Rozenberg G. S., Zinchenko T. D. Quantitative hydroecology: methods of system identification. — Toliyatti : IEVB RAN, 2003. — 463 p. — Russian.

Skorupski M. Mites (Acari) from the order Gamasida in the Wielkopolski National Park // Fragm. faun. — 2001. — **44**, 1. — P. 129–167.

Storozheva N. A., Tertyshny O. S., Fursov V. N., Kolodochka L. O. Krasnokutsk dendrological park as reservation of zoophagous arthropods against pests of fruit garden // Abstracts for scientific conf. for 25th anniversary of Krasnokutsk horticultural establishment (Krasnokutsk, Kharkiv oblast, July 13–15, 1993). — Krasnokutsk, 1993. — P. 149–154. — Ukrainian.