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Detection and ecological characteristics of the alien mite *Aculus taihangensis* (Acari: Eriophyoidea) on *Ailanthus altissima* in the Botanical Gardens of Kyiv and Zhytomyr

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Abstract. Originally used for landscaping, the *Ailanthus altissima* (Mill.) Swingle) has become an invasive species requiring biocontrol, with the *Aculus taihangensis* mite as one of its potential agents. Given this, research aimed to determine the species composition of herbivorous mites on *A. altissima* trees in the Botanical Gardens of Kyiv and Zhytomyr and identify the peculiarities of their distribution and development. To achieve this goal, leaf samples were collected from *A. altissima* plants, with further identification of the detected mites according to the methods

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accepted in acarology. As a result of the monitoring, the alien mite *A. taihangensis* of the superfamily Eriophyoidea was detected on *A. altissima* plants for the first time in Ukraine, namely in the Fomin Botanical Garden of the National Academy of Sciences of Ukraine and the Botanical Garden of Polissya National University. It was found that more intensive reproduction of this phytophage occurs on female plant specimens compared to male ones. The mites preferentially colonise and reproduce more intensively on the leaves of the lower part of the crown, where the air humidity is much higher than in the upper part. These data are important for estimating the number of *A. taihangensis* populations to optimise sampling. It was found that the intensity of mite reproduction during the growing season of host plants gradually increases. Thus, the intensity of reproduction of the first generation of mites was low (0.14-0.70 times), while for the next generation of phytophagous mites, this index increased and reached 0.97-1.3. The comparison of morphological measurements of *A. taihangensis* collected in different ecological and geographical zones confirmed the high variability of individual characteristics in the new habitat. Three groups of traits were identified according to the level of variability: high, moderate, and low variability. Results add to the knowledge about the diversity of eriophyoid mites in Ukraine and their impact on *A. altissima*

Keywords: eriophyoid mites; bioagent; invasion; morphological variability; phytophag; tree crown

Introduction

Biological invasions – the invasion of alien species (invasive species) into ecosystems outside their natural ranges – usually occur for three main reasons: self-dispersal of organisms associated with fluctuations in their numbers and climate change; deliberate introduction of economically important ("useful") organisms (plants, fish, birds, mammals) by humans; accidental introduction with ballast water and ship fouling, with agricultural products, with introductions of "useful" organisms, baggage, etc.

One of the invasive and environmentally harmful trees of Heaven is the *Ailanthus altissima*, which was deliberately cultivated in Europe and Ukraine for urban landscaping in the 19th and 20th centuries and was also used as a perspective phytomeliorative species for the reforestation of sandy areas due to its unpretentiousness to soil and ability to withstand arid conditions. J. Kashefi *et al.* (2022) attributed the invasiveness of *A. altissima* to five characteristics: resistance to extreme environmental conditions, production of numerous allelopathic substances, high seed production and viability, clonal reproduction with abundant sprouts after cutting, and limited insect damage. In addition to its negative environmental impact, the plant also harms human health: Its pollen causes sensitisation, allergic rhinitis, and asthma (Werchan *et al.*, 2022). Due to these aspects, *A. altissima* has been included in the EU's "List of Invasive Alien Species of Concern" (European Commission, 2020).

Controlling the spread of *A. altissima* has become necessary in certain areas, including transport corridors, to ensure safety. In addition, measures to manage it are mandatory under EU legislation. However, traditional control methods remain difficult to implement, expensive, and only partially effective. The use of arboricides is also limited due to the environmental risks involved. Thus, large-scale and long-term eradication of ailanthus is usually not economically viable or feasible. Several studies have been conducted to find alternative, more effective, and environmentally friendly strategies for controlling the spread of ailanthus. A multi-tactical approach with an emphasis on classical biological control looks promising. Research on the use of biological agents to suppress *A. altissima* began in 2004 (Stutz, 2020). To this end, several monophages of this plant have been introduced into the United States, namely the weevils *Eucryptorrhynchus brandti* (Haroldi) and *Eucryptorrhynchus chinensis* (Olivier) (Coleoptera: Curculionidae) (Herrick *et al.*, 2011). As noted by T. Ma *et al.* (2022), these closely related mite species can infest up to 80-100% of *A. altissima* leaves in some regions of China, indicating their high damage and potential threat to the plant.

Another promising bioagent is the mite *Aculus taihangensis* (Hong & Xue, 2005), whose natural range is in Southeast Asia. Research and field observations by S. Stutz (2020) have shown that this mite can damage tall ailanthus seedlings, inhibiting the growth and development of young plants. The study by M. Toldi *et al.* (2022) examined the biological characteristics of predatory mites feeding on *A. taihangensis*. In particular, it was found that the species *Euseius stipulatus* (Athias-Henriot, 1960) can reduce the effectiveness of using eriophyoid mites in biological control programs against *A. altissima.* At the same time, the potential of using the pathogen *Verticillium nonalfalfae* (Inderbitzin, 2011), which can cause verticilliosis in several plants, including *A. altissima*, is being actively studied in different countries. At the same time, researchers B. Dauth *et al.* (2022) warn that significant risks of infection of non-target species accompany the use of such pathogens.

According to J.Q. Ding *et al.* (2006), 46 species of herbivorous arthropods, 16 species of fungi, and several viruses, some of which cause significant damage to the plant, have been recorded in the homeland of *A. altissima*. In China, three species of eriophyoid mites have been found and described on *A. altissima*: *Aculops ailanthi* (Lin, Jin & Kuang, 1997), *Aculops taihangensis* (Hong & Xue, 2005), and *Aculus altissimae* (Xue & Hong, 2005). *A. taihangensis* is believed to have been introduced to Europe (de Lillo *et al.*, 2017) and Turkey (Ozman-Sullivan *et al.*, 2023) with the ailanthus seedlings. In Hungary, another mite species, *Aculus mosoniensis* (Ripka & Ersek, 2014), was described as infesting *A. altissima* trees. Based on new morphological and molecular research, *Aculus mosoniensis* and *Aculops taihangensis* are classified as *Aculus* (Keifer, 1959), with the former species being considered a junior synonym of the latter (de Lillo *et al.*, 2022). That is, only the *Aculus taihangensis* mite has been introduced to Europe from China, and its presence has been confirmed in 13 European countries: Albania, Austria, Bulgaria, Croatia, Greece, Italy, Macedonia, Montenegro, Romania, Serbia, Slovenia, France, and Hungary (Ozman-Sullivan *et al.*, 2023).

The above facts indicate active migration of herbivorous mites from the natural range of *A. altissima* to new regions, particularly Europe, which makes it necessary to study their distribution and biological characteristics in the introduced environment.

In light of this, local research in the Botanical Gardens of Ukraine deserves special attention, as it allows the timely detection of new associations between pests and host plants, as well as assessment of potential phytosanitary risks to the local flora. In connection with the identification of potentially dangerous herbivorous mites for *A. altissima* in Europe, the study aimed to investigate the phytosanitary status of this plant in the conditions of the Botanical Gardens of Kyiv and Zhytomyr. The main focus was on collecting and analysing leaves with signs of damage, identifying the detected mites by comparing them with species described in the scientific literature, and establishing the peculiarities of their distribution in the crown tiers. A separate aspect was the study of the impact of tree sex on the dynamics of mite numbers.

Materials and Methods

The study was conducted during the 2021-2023 growing seasons by route surveys of male and female *A. altissima* trees growing side by side in the Fomin Botanical Garden (Kyiv, 50°44’ N, 30°50’ E) and the Botanical Garden of Polissia National University (Zhytomyr, 50°25’ N, 28°69’ E). The trees were more than 100 years old, up to 16-20 m high, with a trunk diameter of 0.6-0.7 m. The vegetation period of both sexes began in early May, with flowering occurring simultaneously at the end of June. Monitoring was carried out from May to September twice a month. For the detection of mites, transparent adhesive tape was used according to the method by L. Bondareva *et al.* (2023). The tape was pressed with a finger with the adhesive side to the lower surface of the leaf. Then, the tape with the prints was applied to the slide and separated from the roll with scissors. The location of the mites was marked with a marker. The use of adhesive tape for the study of Eriophyoid allowed us to quickly obtain data not only on the presence of the object but also to identify almost all stages of the pest. To investigate the degree of mite infestation of young leaves on female and male ailanthus plants, 10 leaves from 10 trees were randomly selected in early May in the Fomin Botanical Garden. In the Botanical Garden of Polissya National University, samples were taken from three levels of the crown: lower tier (up to 1.0 m), middle tier (1.1-2.0 m) and upper tier (above 2.1 m). For each level, 5 trees were selected, from which 10 leaves were randomly cut from different branches using garden shears (for the middle and upper tiers). The leaves were placed in paper bags, labelled and transported to the laboratory for further microscopic analysis. In the laboratory, under an Optika B-350 microscope (Country of manufacture – Italy) using a dissecting needle soaked in glycerol, mites were examined at 80x magnification, and the number of leaves with mites, the average number of mites per leaf, including adults and pre-magical stages, were counted. The study was conducted in accordance with the Convention on Biological Diversity (1992).

Eriophyoid mites were stored in 70% ethyl alcohol with 5-6% glycerol. Subsequently, they were placed in Hoyer’s medium, without fibres, and then kept on a heating plate for two hours at 50°C. The mites were identified by comparing the external structure of the adults with the descriptions and original drawings given in research by X.-Y. Hong & X.-F. Xue (2005), G. Ripka & L. Érsek (2014), E. de Lillo *et al.* (2022), S.K. Ozman-Sullivan *et al.* (2023). To study the variability of morphological characters of *A. taihangensis*, mite specimens placed in a drop of a mixture of glycerol and sodium hypochlorite solution, which was used to discolour the covers quickly, were used. Morphometric measurements were performed using an eyepiece micrometer. All measurements of mites were performed according to the method proposed by J. Amrine & D. Manson (1996), with dimensions in micrometres (μm). The study analysed 24 protogynous females and 6 males. The reproduction rate of mites is calculated by the formula (Stankevych & Hornovska, 2022):

$$Rr = Na / Nn, \qquad (1)$$

where *Rr* is the reproduction rate; *Na* – absolute number of species in this year; *Nn* – the same indicator in the previous year. The range of normal response of characteristics was determined according to M. Kliuchevych *et al.* (2020):

$$D = a - c, \qquad (2)$$

where D – range of normal response; a – the maximum (max) value of the parameters of characteristic; c – minimum (min) value of the parameters of the characteristic. Microsoft Excel and the "STATISTICA" statistical package were used for data processing and presentation. The studied samples are in the collection of mites of the laboratory of entomology and resistance of crops against pests of the Institute of Plant Protection of the National Academy of Sciences.

Results and Discussion

During regular inspections of *A. altissima* for herbivorous mites in the territory of the Fomin Botanical Garden (Kyiv) and the Botanical Garden of Polissya National University (Zhytomyr), the mite *A. taihangensis* was first detected and studied (Fig. 1).

Figure 1. *Aculus taihangensis*
Source: photo by the authors

Female: Body fusiform, 225-278 long, 57-59 width. Gnathosoma 22, projecting obliquely down. Prodorsal shield 39-42 long; prodorsal shield with frontal lobe, prodorsal shield design with the network. Dorsal tubercles on rear margin, 33 apart, scapular setae (sc) 50 projecting posteriorly. There is a stern line. Coxal area with granules. Dorsal annuli 45-47, with small dot microtubercles on rear annular margins, and ventral annuli 77-79, with small microtubercles on rear annular margins. Female genitalia 11 long, 21 wide coverflap with 8 longitudinal ridges, proximal setae on coxistemum 25 long.

Legs I 45 long, femur 13, basiventral femoral setae 10; genu 7 long, antaxial genual setae 25 long; tibia 12, paraxial tibial setae 5, located near the dorsal base; tarsus 8 long; empodium simple, 5-rayed, solenidion not knobbed.

Legs II 39 long, femur 11, basiventral femoral setae 11; genu 6 long, antaxial genual setae 13 long; tibia 10; tarsus 8 long; empodium simple, 5-rayed, solenidion not knobbed.

Male: 275-180 long, 64-66 width; proximal setae on coxistemum III 20 long.

Since the presence of *A. altissima* has been confirmed in 27 European countries (EPPO, 2024) and the identification of *A. taihangensis* has been confirmed in 13 European countries, it is not surprising that the mite has also been found in Ukraine.

It is known that some researchers have used morphological characters and measurements to identify *A. taihangensis* found in its native environment and individuals introduced to different ecological and geographical zones of Europe and Turkey. Compared them with our data to study the variability of these traits or their reaction rate when the phytophagous is moved to new environmental and geographical conditions. It is known that the reaction rate is the range of adaptation that determines the limits of an organism's variability. It arises under the influence of all environmental factors and is controlled by the organism's genotype.

Table 1 shows the morphometric measurements and quantitative indices of the characteristics of protogynous females of *A. taihangensis* collected by acarologists from different regions of the world, as well as our data. The comparative analysis shows that the variability of mite characteristics used to identify this species found in its native range (China) and those introduced into new ecological and geographical conditions in Hungary, Italy, Turkey, and Ukraine is characterised by a relatively high degree of variability and varies in a fairly wide range.

Table 1. Morphological measurements (μm) of *A. taihangensis* protogyne females

Characters		Sources				
		X.-Y. Hong & X.-F. Xue (2005) (China)	**G. Ripka & L. Érsek (2014) (Hungary)**	**E. de Lillo *et al.* (2017) (Italy)**	**S.K. Ozman-Sullivan *et al.* (2023) (Turkey)**	**Personal data (Ukraine)**
Body	length	288	205-330	237-275	242-290	225-278
	width	75	68-78	55-57	56-60	57-59
Prodorsal shield	length	38	40-50	40-45	42-45	39-42
Genital coverflap	length	18	18-23	10-12	10-12	11
	width	25	23-26	21-22	21-22	21
	ridges	8	13-14	10	10	8-9
Body semiannuli	dorsal	51	50-59	45-50	44-46	45-47
	ventral	87	70-83	73-85	71-79	77-79
The number of empodium rays	rays	5	5	5	5	5

Source: compiled by the authors

According to the ability to change the research of characteristics in the new conditions of the mite's existence, several groups were identified: with high, moderately low variability, and stability of development. The characteristics with a high range of reaction norms (more than 70%) include the number of rollers on the genital coverflap and their length parameters. Characteristics with a moderate range of variability (40-69%) include body length and dorsal body semiannuli. Characteristics with a low range of variability (up to 39%) include the rings of the ventral surface of the body, the length of the scutellum, and the width of the genital coverflap. Only one characteristic, the number of empodium rays, is characterised by the stability of its manifestation in all studied mite populations.

Aculus taihangensis overwinters under the outer scales of a bud. In spring, when the leaves blooming, it leaves its wintering places and begins to feed on young leaves. The mites suck plant sap with their mouthparts, causing the leaf margins to curl upwards and turn yellowish. As noted by several authors (Ripka & Érsek, 2014; de Lillo *et al.*, 2017), necrosis, premature leaf fall, and even death of young trees can be observed on heavily infested plants. In our case, no such manifestations were observed. *A. taihangens* is a wandering eriophyoid mite that is openly present on the leaf surface, mainly on the underside, and can form large populations on forage plants. During the years of research, have observed accumulations of eggs, nymphs, and adult mites along the midveins of the lower leaf surface. The study of the *A. taihangensis* population dynamics during the growing season revealed stable development, characterised by two to three generations in Kyiv. It was found that the intensity of mite reproduction during the growing season gradually increases. Thus, for the first generation, the intensity of reproduction was low (0.14-0.70), while for the next generation of the phytophagous mites, this indicator increased and amounted to 0.97-1.3. The number of mites peaked in July and decreased in late August. In September, no mites were found on the leaves.

At the beginning of May, when the active unfolding of leaf blades on female and male trees occurs, studied the mite infestation of ailanthus leaves in the Fomin Botanical Garden. The analysis of the results (Fig. 2) showed that the leaves of female plants were infested much more than those of male plants. During the three years of observations, the degree of colonisation of young leaves on female trees ranged from 10.8 to 11.3%, while for male specimens, this figure was lower and varied from 8.5 to 9.7%. Summarising the data for three years, the average level of *A. taihangensis* mite infestation on female plants was 11.03%, while on male plants, it was 9.1%, indicating a steady trend of higher susceptibility of female plants to infestation.

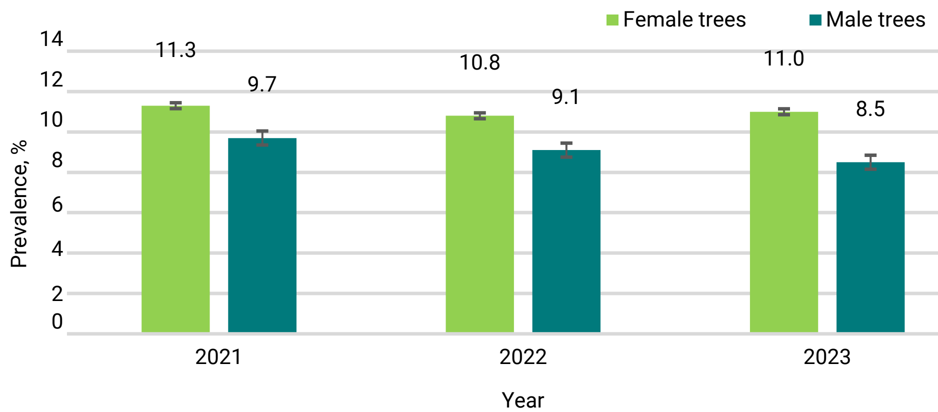

Figure 2. Prevalence of *A. taihangensis* on different sexes of *A. altissima* plants in the academician O.V. Fomin Botanical Garden (2021-2023)

Source: compiled by the authors

Possible differences may be due to both morphological characteristics of the leaf surface and the chemical composition of the leaves, which affect mite behaviour. For a deeper understanding of the mechanisms of differences in mite infestation, further research should include analysis of leaf chemical composition, microstructural characteristics of the epidermis, and environmental factors that may affect the spread of *A. taihangensis*.

In the Botanical Garden of Polissia National University from 2021-2023, the distribution of the mite *A. taihangensis* on different levels of the crown of *A. altissima* was researched. The data analysis (Table 2) showed that the mite infestation of leaves was highest in the lower crown tier, where the average infestation rate was 80.9% over three years. A much smaller number of mites was found in the middle tier (17.7%), and in the upper tier, the infestation was minimal (0.4%). The obtained results indicate a pronounced tendency to colonise the lower branches, which is probably due to more favourable microclimatic conditions, especially high humidity and shading. This confirms the adaptation of *A. taihangensis* to high humidity conditions.

Table 2. *A. taihangensis prevalence* in crown tiers of *A. altissima* in the Botanical Garden of Polissya National University (2021-2023)

Year	Prevalence, %		
	Lower tier	Middle tier	Upper tier
2021	83.7 ± 0.61	16.3 ± 0.56	0.49 ± 0.01
2022	80.6 ± 0.54	19.2 ± 0.64	0.31 ± 0.03
2023	81.8 ± 0.29	17.7 ± 0.54	0.41 ± 0.03
Year	Prevalence, %		
	Lower tier	Middle tier	Upper tier
On average	80.9 ± 0.49	17.7 ± 0.58	0.40 ± 0.02
LSD_{05}	0.5	0.6	0.02

Source: compiled by the authors

X. Han *et al.* (2020) researched the effect of air moisture on the behavior and abundance of *Phyllocoptes maackis* X. Han *et al*. on *Euonymus maackii* Rupr. The authors noted that the number of species was higher on young leaves, which contain more moisture. At the same time, the authors' research showed that mite activity decreased under unfavourable conditions, such as low temperatures or heavy precipitation. Thus, mites are sensitive to changes in the environment, which highlights the importance of studying these factors to understand their environmental impact.

Aculus taihangensis belongs to the superfamily Eriophyoidea, which attracts considerable attention from researchers because it contains aggressive pests of fruit, vegetable, ornamental, and other crops (Yanovskyi *et al.*, 2021; 2022). This superfamily is also intensively studied due to the suitability of some species for controlling the density of herbaceous weeds and invasive plants on agricultural lands and in natural ecotopes (Magud *et al.*, 2007). Due to the narrow specialisation of many eriophyoid mites on certain plant species, they are considered as potential biological control agents capable of regulating populations of undesirable vegetation without harming target crops. This combination of phytosanitary importance and ecological potential makes the superfamily Eriophyoidea one of the key groups in modern acarofauna research.

At the same time, understanding the mechanisms of spread of these mites is equally important, as the ability to disperse effectively determines their ecological plasticity and potential for biological control. According to research by K. Michalska *et al.* (2010), eriophyoid mites are usually spread by air currents, although rain, snow, and phoresis remain less common mechanisms. All but the last of these methods are based on random factors and may be ineffective, especially if the host population density is low or the number of mites capable of migration is small. Vertical transmission can potentially be more effective in ensuring the establishment of new hosts, but this mechanism is not well understood in eriophyoid mites (Chetverikov *et al.*, 2022). In this context, it is important not only to understand how eriophyoid mites spread but also to assess the consequences of their invasion into new ecosystems. This necessitates constant monitoring of the emergence of new species and analysis of their potential for invasion.

The rapid spread of invasive species in the world, including in Ukraine, forces scientists to closely monitor this phenomenon, regularly publish new data on findings, and compile initial species lists. This is aimed at raising awareness of the problem. At the same time, only a small proportion of alien species become invasive. For example, in Europe, out of approximately 12,000 alien species, only 10-15% have been designated as invasive (Sundseth, 2016).

Several species of alien mites and insects have been recorded in Ukraine for the first time (Bondareva & Chumak, 2020). For example, the mite *Pentamerismus oregonensis* (McGregor, 1949). Insects include the moths *Phyllonorycter platani* (Staudinger, 1870), *Phyllonorycter issikii* (Kumata, 1963), *Cameraria ohridella* (Deschka & Dimic 1986), *Parectopa robiniella* (Clemens, 1863) (Matsakh & Kramarets, 2020), *Metcalfa pruinosa* (Say, 1830) (Uzhevskaya *et al*., 2012), *Agrilus planipennis* (Fairmaire, 1888) (Drogvalenko *et al*., 2019), *Corythucha arcuata* (Say, 1832) (Meshkova *et al*., 2020), and other species of invasive biota in Ukrainian ecosystems (Babytskiy *et al*., 2023).

This list demonstrates the increasing frequency of new alien species in Ukraine, which indicates the relevance of continuous monitoring and the need for scientific assessment of their potential impact on local ecosystems. Particular attention is drawn to both mites and insects, which can exert significant pressure on native species and cause disturbances in ecological balance.

When studying the spread of living organisms beyond their natural range, little attention is paid to the causes related to the biological characteristics of the invasive species themselves. There are many reports in the literature that the trigger for invasion can be individual elements or a complex of external conditions (temperature, humidity, climate change towards higher temperatures), a sharp and multifaceted increase in the globalisation of all human activities, etc. S.E. Meyer *et al.* (2021) examined how invasive species responded to natural and human-caused disturbances such as fire, soil disruption, and climate change. The authors highlighted that invasive species often reacted more rapidly than native ones, allowing them to dominate disturbed ecosystems. X. Zhang *et al.* (2022) found that invasive plants showed greater growth than co-occurring native species in live soil subjected to a drought-rewetting cycle. This demonstrated that invasive species had an adaptive advantage under fluctuating climate conditions, which facilitated their further spread.

A. Mosyakin (2009) summarised the main hypotheses of plant invasiveness: escape from "natural enemies", "evolution of invasiveness", "evolution of increased competitiveness", "new weapons", "empty niche", and "species richness" The author notes that the above hypotheses are, in fact, a generalisation of practical data available in modern invasive biology.

However, none of the hypotheses claims to be universal but explains the invasive process in terms of the action of one factor or group of factors. It is emphasised that when developing hypotheses of invasiveness and practical measures to combat phytoparasites, the key role should belong to environmental factors and the trophic component of the biotic environment of phytoparasites. Therefore, the importance of studying the biological characteristics of the invasive species themselves is not emphasised. At the same time, it can be assumed that, together with plants of a certain species, the whole complex or individual trophically related parasites of a given plant species may simultaneously enter new ecological and cenotic conditions. The question of why only certain species survive, and not only survive, but also show the ability to engage in outbreaks of mass reproduction, remains open.

One of the reasons for this phenomenon is escape from "natural enemies", "empty niche", etc. However, other members of the consortium of this invasive plant also find themselves in similar conditions. Thus, in the case of the introduction of *A. altissima* plants, other phytophages and pathogens of this species may enter Europe, Turkey, and the United States (Bielski *et al.*, 2024). For example, the Chinese weevil species *E. brandti* and *E. scrobiculatus*, which naturally damage *A. altissima*, are currently being tested in the United States as potential biological control agents for this species (Herrick *et al.*, 2011; Ma *et al.*, 2022). However, the situation with mites is somewhat different – according to M. Skvarla *et al.* (2021), only a few mite species have been recorded on *A. altissima* in new areas, indicating limited movement of this group of phytophages with the plant.

Agreeing with the entire set of hypotheses of the influence of external factors on the invasiveness of biota in general, assume that this phenomenon is also based on the individual genetic characteristics of a species, which can be expressed by the variability of the organism's characteristics. The natural laws of the functioning of the triad 'genome – characteristics – environment' are generally not sufficiently studied and are not taken into account when studying the phenomenon of biota invasiveness.

Conclusions

Research is an important step forward in studying the eriophyoid mites of Ukraine associated with such a highly invasive species as *A. altissima*. The presence of the alien *A. taihangensis* in Kyiv and Zhytomyr is a new record for the fauna of Ukraine. Comparison of morphological measurements of *A. taihangensis* collected in different ecological and geographical zones allowed us to identify traits with high, moderate, and low variability and one stable trait – the number of empodium rays. It was found that *A. taihangensis* is a polycyclic species capable of developing two or three generations during the growing season. The population size reaches its peak in July and sharply decreases by September. The predominant colonisation of the lower tier of the tree crown by mites was found. Thus, the level of leaf mite infestation in the lower tier of the crown for three years was 80.9%, in the middle tier, the population was much lower, 17.7%, while in the upper tier it reached only 0.4%, indicating a clear vertical differentiation in the distribution of mites, which is explained by favourable microclimatic conditions, in particular, high humidity and shading. The influence of the sex of *A. altissima* plants on the level of mite infestation was noted: female individuals were more infested than male ones. The average level of *A. taihangensis* mite infestation on female plants was 11.03%, while on male plants it was 9.1%. The results of our observations suggest that *A. taihangensis* does not perform a significant function as an effective biological agent for controlling the population of *A. altissima*. This is because the level of damage to the leaf surface of trees was insignificant: the damage did not have a significant impact on the physiological state of adult trees growing in the territory of the Botanical Gardens in Kyiv and Zhytomyr. In this regard, there is a need for further, larger-scale research to clarify the natural distribution of *A. taihangensis* throughout Ukraine. It is also important to collect additional data on its biology, ecological preferences, and potential impact on different age groups of *A. altissima* in open natural ecosystems.

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None.

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Виявлення та екологічна характеристика чужорідного кліща *Aculus taihangensis* (Acari: Eriophyoidea) на айланті найвищому (*Ailanthus altissima*) в ботанічних садах Києва та Житомира

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Анотація. Спочатку використаний для озеленення, айлант найвищий (*Ailanthus altissima* (Mill.) Swingle)) став інвазійним видом, що потребує біоконтролю, одним із потенційних агентів якого є кліщ *Aculus taihangensis*. З огляду на це, дослідження було спрямоване на визначення видового складу рослиноїдних кліщів на деревах *A. altissima* в ботанічних садах Києва та Житомира, виявлення особливостей його поширення та розвитку. Для досягнення цієї мети було проведено збір зразків листя з рослин айланта з подальшою ідентифікацією виявлених кліщів згідно з прийнятими в акарології методами. В результаті проведеного моніторингу вперше на території України, а саме в Ботанічному саду ім. академіка О. В. Фоміна Національнї академії наук України та Ботанічному саду Поліського національного університету, на рослинах *A. altissima* виявлено чужорідного кліща *A. taihangensis* надродини Eriophyoidea. Встановлено, що більш інтенсивне розмноження цього фітофага відбувається на жіночих екземплярах рослин у порівнянні з чоловічими. Кліщі переважно заселяють та інтенсивніше розмножуються на листках нижньої частини крони, де вологість повітря значно вища, ніж у верхній частині. Ці дані важливі для оцінювання чисельності популяцій *A. taihangensis* з метою оптимізації вибірки. Встановлено, що інтенсивність розмноження кліщів протягом вегетаційного періоду рослин-живителів поступово зростає. Інтенсивність розмноження першого покоління кліща була низькою

(0,14-0,70 раз), тоді як для наступного покоління фітофага цей показник збільшився і сягав 0,97-1,3. Проведене порівняння морфологічних вимірів *A. taihangensis*, зібраних у різних еколого-географічних зонах, підтвердило високу варіабельність окремих характеристик у нових умовах існування. Виділено три групи ознак за рівнем мінливості: з високою, помірною та низькою варіабельністю. Отримані результати доповнюють знання про різноманітність еріофіоїдних кліщів в Україні та їх вплив на *A. altissima*

Ключові слова: еріофіоїдні кліщі; біоагент; інвазія; морфологічна варіабельність; фітофаг; крона дерева