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THE SPIDER MITE *SCHIZOTETRANYCHUS SPIREAFOLIA* (ACARI, TETRANYCHIDAE), SPECIFIC PEST OF *SPIRAEA* IN THE A. V. FOMIN BOTANICAL GARDEN

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The Spider Mite *Schizotetranychus spireafolia* (Acari, Tetranychidae), Specific Pest of *Spiraea* in the A. V. Fomin Botanical Garden. Zhovnerchuk, O. V., Chumak, P. Ya. — The spider mite *Schizotetranychus spireafolia* Garman, 1940 is found on plants of the genus *Spiraea* L. in A. V. Fomin Botanical Garden, Kyiv (Ukraine). This is the second record of the species in Ukraine. The species diagnosis with measurements of body, legs and dorsal setae for male and female mites was given. New data on distribution, ecology of mites is obtained, and damage to plants was described for the first time. The pest density was different on various species, forms and sorts of *Spiraea* L. plants, and did not depend on leaf pubescence.
Key words: Tetranychidae, *Schizotetranychus spireafolia*, *Spiraea*, species diagnosis, morphometry, distribution, population density, pest damage, botanical garden, Kyiv, Ukraine.

Introduction

The tetranychid mites (Acari, Tetranychidae) are widespread plant pests. The family inclydes 1302 species and this number is constantly growing (Migeon, Dorkeld, 2006–2017). New tetranychid species, previously known mainly from southern regions, have been recently recorded in Ukraine (Zhovnerchuk, 2012, 2016; Akimov, Zhovnerchuk, 2016 etc.). The expansion is often driven by climatic changes causing habitat and species advancement to higher latitudes. However, this reason for expansion is difficult to prove in case of microscopic animals, such as spider mites. A phytophage can also invade new area with the introduction of plant species and varieties from other regions of the country, or even other countries (Ehara, Masaki, 2001; Ferragut et al., 2013). This possibility should not be underestimated, because even a single specimen can start a colony that in time may cause a mass pest outbreak.

A single female of a rare in Ukraine monophagous species *Schizotetranychus spireafolia* Garman, 1940 has been already recorded from in Ukraine in samples collected by S. G. Pogrebniak near Lozovatka village, Bobrynetsky District of Kirovohrad (now Kropyvnytsky) Region on *Spiraea* sp., in 2007 (the material is deposited in the collection of Natural History Museum of the National Academy of Sciences of Ukraine) (Zhovnerchuk, 2012).

Currently, this species was found in the A. V. Fomin Botanical Garden (FBG).

This phytophagous mite has not been not registered in FBG during our previous study in 2004–2006 (Akimov et al., 2007). The pest was likely to appear in FBG with the introduced plants of the genus *Spiraea* L.

Material and methods

In 2015–2017, plants of the genus *Spiraea* were monitored for pests in FBG. More than 120 species, varieties and forms of plants grown in the garden were surveyed. The material was collected in July–September 2016–2017. Plants were shaken and beaten so that mites fell off onto a black surface where mites could be picked with a fine paint brush.

Totally, 22 species of the genus *Spiraea* were examined. The mite population density was determined on a nine-point scale (table 1). The Latin plant names are given according to Z. G. Bonyuk (2008).

Mites were mounted on slides in Hoyer's liquid. They were identified and measured using Optika B-350 microscope. Microphotography of living objects was performed using Leica M 165C microscope, mounted mites were photographed using Optika B-350 microscope and Sigeta digital camera at the Department of Acarology of the I. I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kyiv.

Table 1. The qualitative and quantitative scale of the mite population density

Degree of pest population density in points	Qualitative assessment of pest population density	Pest-covered leaf surface, %
1	very weak	< 5
2–3	weak	5–25
4–5	average	26–50
6–7	strong	51–75
8–9	very strong	> 75

Table 2. Morphometric characters of *Sch. spireafolia* (n = 5)

Parameter	M ± m, μm	
	female	male
Body length	357.2 ± 7.3	279.2 ± 4.8
Body width	274.3 ± 6.9	186.5 ± 6.2
Length of leg I	177.0 ± 1.6	163.0 ± 2.5
Length of leg II	154.8 ± 2.2	139.6 ± 1.2
Length of leg III	169.2 ± 1.2	142.0 ± 3.7
Length of leg IV	175.4 ± 2.5	149.4 ± 3.7
Length of the dorsal setae	30.9 ± 0.7	25.1 ± 1.08

Fig. 1. Live mites and egg.

Results and discussion

Diagnosis of *Schizotetranychus spireafolia*. The mites pale yellow, with blurred dark spots on the sides of body (fig. 1). The eyes clearly visible, bright carmine red. The body oval-shaped and longer than legs (fig. 2, *a*, *b*). Dorsal setae not pubescent, widened near each base, tapering to a slender, acute tip and not longer than the distance between their bases (fig. 2, *c*). Ventral setae short, not pubescent. Spinneret on palp tarsus slender and long. The spinules almost as long as spinneret (fig. 2, *d, e*). The empodium split in two thick claws (fig. 2, *f*). The peritremes slender and not anastomosed, the terminal chamber widened and elliptical (fig. 2, *g*). Aedeagus short, with a small hook and without barb, and it bends upward at less than a right angle to form a slender, sigmoid, acuminate tip (fig. 2, *h*).

The measurements in the original species description (Garman, 1940) include only the lengths of adult specimens and diameter of laid eggs. Our own morphometric data of body, legs and dorsal setae lengths of male and female *Sch. spireafolia* mites are presented in table 2.

The eggs are large, round, pale yellow or pale green (fig. 1).

Type locality: USA.

Host plant of the type: *Spiraea latifolia*.

The studied species mostly infests various species of the genus *Spiraea*. *Cajanus cajan* and *Saccharum officinarum* also are known as its host species (Migeon, Dorkeld, 2006–2017).

Distribution. Mites of the species *Schizotetranychus spireafolia* were previously found in the USA (Garman, 1940; Pritchard, Baker, 1955; Prasad, 1970), Poland (Boczek, Kropczynska, 1964), India (Gupta, 1976, 1992), China (Wang, Cui, 1992), and Ukraine (Zhovnerchuk, 2012).

Having analyzed literature, we found no descriptions of the nature and possible scope of damage that *Sch. spireafolia* mites can inflict on the *Spiraea* plants. According to our observations, the mite webbing occurred in insignificant amounts, but it is quite dense and

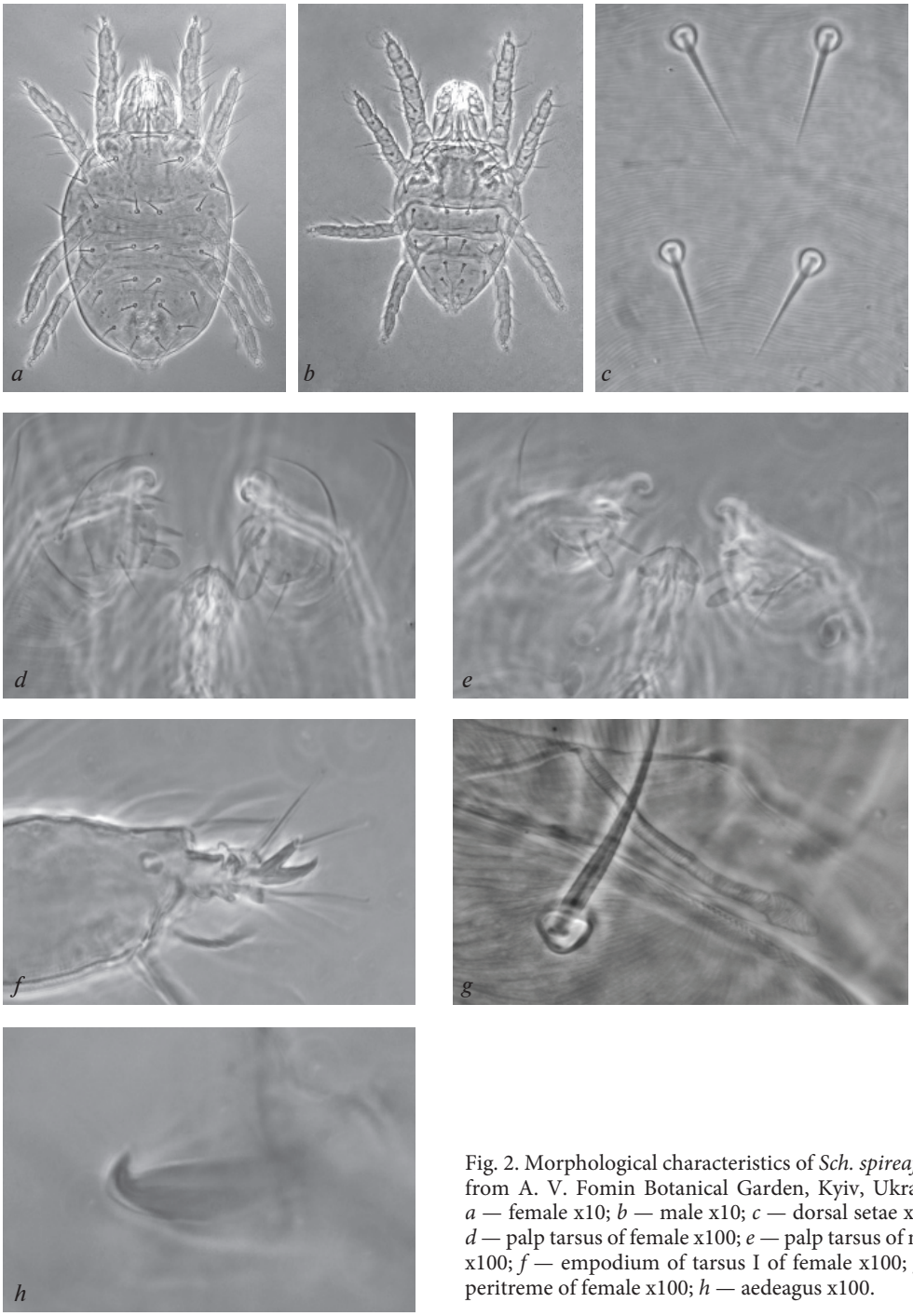

Fig. 2. Morphological characteristics of *Sch. spireafolia* from A. V. Fomin Botanical Garden, Kyiv, Ukraine: *a* — female x10; *b* — male x10; *c* — dorsal setae x100; *d* — palp tarsus of female x100; *e* — palp tarsus of male x100; *f* — empodium of tarsus I of female x100; *g* — peritreme of female x100; *h* — aedeagus x100.

Fig. 3. *Spiraea japonica* L. infested with *Sch. spireafolia* mites: *a* — upper surface of leaf, *b* — lower surface of leaf.

localized in small "islets". If the damage to plants is severe, the mites produce brown spots (fig. 3, *a*, *b*) on both leaf surfaces.

Sch. spireafolia was found in A. V. Fomin Botanical Garden on 12 of 22 studied species, forms and sorts of *Spiraea* L. plants. The varying pest densities are shown in table 3.

The most severe damage was observed in four plant species: *S. albiflora, S. lasiocarpa, S. latifolla* and *S. japonica* ("Little Princess"). Four other *Spiraea* species also were quite strongly infested (6–7 points by the scale): *S. bumalda* Burvenich "Crispa", *S. crenata* L., *S. hypericifolia* L., and *S. mollifolia*. The infestation of three plant species (*S. semperflorens*, *S. uratesis*, and *S. rubella*) was insignificant, with no noticeable signs of damage. The bushes are planted near to each other and there are no dividing barriers, the overall insolation and moisture conditions are quite similar, and yet *Sch. spireafolia* was not found on the plants of eight studied species (*S. cana* Waldst. et Kit., *S. veitchii* Hemsl., *S. densiflora* Nutt., *S. douglasii* Hook., *S. virgata* Franch., *S. nipponica f. tosaensis* (Vatabe) Makino Nana, *S. ferganensis* Pojark., and *S. fritschianna* Schneid.). The mite's reaction to different plant species may vary with the differences in leaf nutritional value and surface morphology, presence of toxic components and accumulation of secondary metabolites, presence of necessary enzymes in mites and their digestive ability, etc. (Barabanova, 1973; Boom et al., 2003).

The severity of infestation by mites may depend on the degree of leaf blade pubescence. However, researchers do not fully agree on its role (Skorupska, 1999). All of the plant species in this study can be roughly divided into three groups: naked (non-pubescent); weakly pubescent; strongly pubescent (Bonyuk, 2008). The comparison of leaf blade pubescence and severity of mite infestation, however, did not reveal any consistent relationship. The mites damaged naked leaves of *S. latifolla*, *S. albiflora* and *S. lasiocarpa* just as intensely as strongly or weakly pubescent leaves of *S. japonica, S. hypericifolia* and *S. mollifolia.*

Table 3. The population density of *Sch. spireafolia* mites on the plants of the genus *Spiraea* in A. V. Fomin Botanical Garden (2016–2017)

The host of *Sch. spireafolia*	Pest density on plants (in points)
Spiraea albiflora (Mig.) Zab.	8–9
Spiraea bumalda Burvenich, "Crispa"	6–7
Spiraea bumalda Burvenich, "Goldflame"	2–3
Spiraea crenata L.	6–7
Spiraea hypericifolia L.	6–7
Spiraea japonica L., "Little Princess"	8–9
Spiraea lasiocarpa Kar. et Kir	8–9
Spiraea latifolla (Ait.) Borkh.	8–9
Spiraea mollifolia Rehd.	6–7
Spiraea rubella Dipp.	1–2
Spiraea semperflorens Zab.	1–2
Spiraea uratesis Franch.	1–2

The leaf hairs are assumed to provide the pest colonies with additional protection against adverse abiotic factors and natural enemies. Supposedly, there is also a unique ultra-microclimate at the near-surface 1 mm air layer, which is quite important for tetranychid mites (Lindt, 1964). Although *Sch. spireafolia* mites produce moderate amounts of webbing on *Spiraea* plants in FBG, it is quite dense and sufficiently masks the pests and their eggs. It looks like the principal factor ensuring the favorable ultra-microclimate of leaf surface is the webbing, while the leaf pubescence does not matter as much.

It is impossible to exclude the probability of *Sch. spireafolia* later infesting other *Spiraea* species and varieties in FBG, taking into account that a sort's stability to any specialized phytophage is always relative and over time even a relatively very stable variety becomes favored by the pest (Vilkova, Fasulaty, 2001).

Conclusions

Schizotetranychus spireafolia mites are found on twelve species of the genus *Spiraea* in A. V. Fomin Botanical garden. This is the second record of the species in Ukraine. The mites may have inhabited the studied area with the introduction of their host plants. The species description is supplemented for the first time with the morphometric data of body, legs and dorsal setae for both female and male *Sch. spireafolia*. At the time of inspection, pests caused the most damage in four plant species: *Spiraea albiflora, Sp. lasiocarpa, Sp. latifolla* and *Sp. japonica* (sort "Little Princess"). In the cases of severe damage to plants, mites can be easily found at the abaxial leaf surface by their islets of dense webbing and by the brownish spots on both leaf surfaces. Pest density at different species and sorts of plant hosts does not depend on the leaf pubescence.

References

Akimov, I. A., Zhovnerchuk, O. V. 2016. Current status and tendencies in diversity and trophic specialization of tetranychidae mites (Acari, Tetranychidae) of the steppe zone of Ukraine. *Ukrainian Entomological Journal*, **1–2** (11), 105–109.

Akimov, I. A., Kolodochka, L. A., Zhovnerchuk, O. V., Omeri, I. D., Samoylova, T. P. 2007. 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*, **41** (6), 521–534 [In Russian].

Barabanova, V. V. 1973. *The morphological and functional characteristics of the digestive systems of several tetranychid mites (Trobidiformes, Tetranychoidea) in connection with their feeding habits*. Abstract of PhD thesis (Biological Sciences, 03.00.08. Zoology). Kiev, 1–23 [In Russian].

Boczek, J., Kropczynska, D. 1964. Studies on mites (Acarina) living on plants in Poland I. *Fragmenta Faunistica*, 11, 161–188.

Boom, C. E.M., Beek, T. A., Dicke, M. 2003. Differences among plant species in acceptance by the spider mite *Tetranychus urticae* Koch. *Journal of Applied Entomology*, 127, 177–183.

Bonyuk, Z.G. 2008. *Plants of the genus Spiraea L*. Kyiv University, Kyiv, 1–248 [In Ukrainian].

Ehara, S., Masaki, M. 2001. Three species of exotic mites (Acari: Tetranychoidea) recently intercepted at Japanese plant quarantine. *Applied Entomology and Zoology*, 36 (2), 251–257.

Ferragut, F, Garzyn-Luque, E, Pekas, A. 2013. The invasive spider mite *Tetranychus evansi* (Acari: Tetranychidae) alters community composition and host-plant use of native relatives *Experimental and Applied Acarology*, 60 (3), 321–341.

Garman, P. 1940. Tetranychidae of Connecticut. *Bulletin of the Connecticut Agricultural Experimental Station*, 431, 67–88.

Gupta, S. K. 1976. Contribution to our knowledge of tetranychid mites (Acarina) with descriptions of three new species from India. *Oriental Insects*, 10, 327–351.

Gupta, S. K., 1992. *Arachnida: plant mites (Acari).* Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal, Part 3, 61–211.

Lindt, I. I. 1963. Biology of the common tetranychid mite (*Tetranychus telarius* L.) in Southern Tadzhikistan. PhD thesis (Biological Sciences, 03.00.08. Zoology). Dushanbe, 1–15 [In Russian].

Migeon, A., Dorkeld, F. 2006–2017. *Spider Mites Web: a comprehensive database for the Tetranychidae*. — (http://www.montpellier.inra.fr/CBGP/spmweb).

Prasad, V. 1970. Some Tetranychoid Mites of Michigan. *The Michigan Entomologist,* 24–31.

Pritchard, A., Baker, W. 1955. *A revision of the spider mite family Tetranychidae*. Memoirs series. Vol. 2. San Francisco, 1–472.

Skorupska, A. 1999. Morfologico-anatomical structure of leaves and female fecundity of genus *Tetranychus* (Acarina, Tetranychidae) on selected scab-resistant apple varieties. *Journal of plant protection research*, 39 (2), 144–151.

Vilkova, N. A., Fasulati, S. R. 2001. Variability and adaptive microevolution of phytophagous insects in agroecosystems in connection with immunogenetical properties of host plants. *Proceedings of the Russian Entomological Society*, 72, 107–127 [In Russian].

Wang, H. F., Cui, Y. Q. 1992. New records of Tetranychidae from China, with description of a new species of *Petrobia*. *Sinozoologica*, 4, 345-347.

Zhovnerchuk, O. V. 2012. Records of mites *Tetranycopsis spiraeae* (Acariformes, Bryobiidae) in Ukraine with a new host-plant. *Vestni k Zoologii*, 46 (4), 318 [In Russian].

Zhovnerchuk, O. V. 2016. Ecology-faunistic review of tetranychid mites (Tetranychidae) of the Black Sea Biosphere Reserve. *Proceedings of zoological museum*, (2014), 45, 10–16 [In Ukrainian].

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