ISSN 0013-8738, Entomological Review, 2018, Vol. 98, No. 2, pp. 255–258. © Pleiades Publishing, Inc., 2018.
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The First Record of a Chigger Mite of the Genus *Neotrombicula* (Acariformes: Trombiculidae) in the Northwest of European Russia

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Received July 5, 2017

Abstract—A chigger mite species, *Neotrombicula absoluta* Schluger, 1966, previously known only from its type locality in Transcarpathian Region of Ukraine, was found in the vicinity of Kurgolovo Village (Kingisepp District, Leningrad Province, Russia). A single specimen of this species was collected off the common shrew *Sorex araneus* L. This is the first record of the genus *Neotrombicula* (which includes the most usual causative agents of trombiculiasis of humans and domestic animals in Europe) in the northwestern part of European Russia.

DOI: 10.1134/S0013873818020173

The main causative agent of trombiculiasis of humans and domestic animals in Europe is traditionally believed to be the harvest mite *Neotrombicula autumnalis* (Shaw, 1790), described as early as the XVIII century. However, chigger mites are very rarely collected directly off humans and pets, and it is on still rarer occasions that such collections are adequately processed and identified. At the same time, according to some new data, other chigger mite species may also be agents of trombiculiasis in Europe (Stekolnikov et al., 2014, 2016). Of special interest is the distribution of species of the genus *Neotrombicula* Hirst, 1925, to which the harvest mite belongs. The European range of this genus is the territory where cases of trombiculiasis are the most likely to be revealed.

Until now, two species of chigger mites have been known from the northwest of European Russia: *Hirsutiella zachvatkini* (Schluger, 1948) and *Ascoschoengastia latyshevi* (Schluger, 1955). In the first works on the chigger mites of the region, all the collection material was identified as *Trombicula autumnalis* (Kirschenblat, 1938; Vasiliev, 1949); however, only *Trombicula zachvatkini* was considered in the next publication, co-authored by an expert in mite taxonomy (Vysotskaya and Schluger, 1953). Both Kirschenblat (1938) and Vasiliev (1949) briefly reported findings of chigger mites on the yellow-necked field mouse *Apodemus flavicollis* (Melchior) and the bank vole *Myodes glareolus* (Schreber) in Peterhof. S.O. Vysotskaya collected over 2400 chigger mites off 113 bank voles and 1 common vole *Microtus arvalis* (Pallas), and also from nests of the common shrew *Sorex araneus* L., the bank vole, and the European water vole *Arvicola terrestris* (L.) in Priozersk District of Leningrad Province; all these specimens were identified as *T. zachvatkini* by E.G. Schluger. A total of 658 specimens of 6 species of rodents were examined in Tosno District but only one larva of *H. zachvatkini* was found on a common vole (Vysotskaya and Schluger, 1953).

Later on, researchers from the Laboratory of parasitology of the Zoological Institute, Russian Academy of Sciences (ZIN RAS) repeatedly collected chigger mites in Leningrad, Pskov, and Novgorod provinces. The great bulk of this material, counting several hundred thousand specimens, consists of *H. zachvatkini* collected off bank voles (Balashov et al., 2002). The second species recorded in the northwestern part of European Russia, *Ascoschoengastia latyshevi*, is represented in the ZIN collections by only nine specimens collected by A.B. Shatrov off bank voles in Sebezhsky District, Pskov Province (Bochkov et al., 2001). Field mice of the genus *Apodemus* are much less frequently infested by chigger mites, and only single specimens have been found on the common shrew *S. araneus* (Balashov et al., 2007). In particular, no chigger mites were collected off this host in Novgorod Province where over a thousand shrews were examined (Balashov et al., 2003).

During examination of relatively recent ethanol-preserved material of chigger mites in the ZIN collections, we discovered a vial with a specimen collected off a common shrew in the vicinity of Kurgolovo Village. After preparation, this specimen was found, quite unexpectedly, to belong not to *H. zachvatkini* but to a species of a different genus, namely *Neotrombicula*. This unanticipated finding considerably expands the known range of the genus and also reveals the need for critical reassessment of the routine strategy of field studies of Trombiculidae.

MATERIALS AND METHODS

Ectoparasites of small mammals were collected by researchers from the Laboratory of parasitology of ZIN RAS in June–August 2006 in the vicinity of Kurgolovo Village, Kingisepp District, Leningrad Province. This work was part of a research project focused on ecological parasitology of forest rodents and insectivores (Balashov et al., 2007). Small mammals were captured with breakback traps arranged in lines of 50 traps each. During the whole study period 150 small mammals of 6 species were examined, including 79 bank voles, 42 common shrews, 10 pygmy shrews *Sorex minutus* L., 7 pygmy field mice *Apodemus uralensis* (Pallas), 3 yellow-necked field mice, and 9 common voles.

Of these mammals, only one common shrew carried a single chigger mite (host specimen no. 469, collected 1 August 2006, collector K.A. Tretyakov). The host was captured in a mixed forb deciduous forest consisting of aspen, birch, and grey alder, at 59°46′24.98″N, 28°05′54.52″E. Since mites of the genus *Neotrombicula* can be visually differentiated from *Hirsutiella*, we examined all the ethanol-preserved material of chigger mites from the vicinity of Kurgolovo using a Micromed MS-1 var. 1S dissecting microscope (Observation Devices LLC, St. Petersburg, Russia) and made preparations of some specimens; however, no other *Neotrombicula* mites were found.

Microscopic preparations in Faure-Berlese fluid were made following the standard technique. They were kept for a week in a temperature controlled chamber at 65°C and then sealed with asphalt varnish. The preparations (ZIN RAS collection of Trombiculidae, nos. 10557–10561) were studied using an MBI-3 microscope with a phase contrast device (LOMO, St. Petersburg, Russia); measurements were made with an eyepiece micrometer. Identification was based on the monograph of Kudryashova (1998), summarizing data on Trombiculidae of the Soviet Union, and the revision of the species group *Neotrombicula vulgaris* (Schluger, 1955) published earlier by the first author (Stekolnikov, 1999), which included the results of examination of the type materials. The standard diagnostic formulae and abbreviations used below have been accepted in chigger mite systematics since the middle of the past century; they are explained in all the monographs on Trombiculidae and in many papers available on the Internet (Kudryashova, 1998; Stekolnikov et al., 2014).

RESULTS AND DISCUSSION

The studied specimen of *Neotrombicula* has the following diagnostic characters: SIF = 7BS-N-3-3111. 1000; fPp = B/B/NNB; fsp = 7.7.7; fCx = 1.1.1; fSt = 2.2; fSc: PL > AL = AM; fD = 4H-[10-4]-14-8-8-5; DS = 53; VS = 35; NDV = 88; Ip = 802; eyes 2 + 2; posterior margin of scutum broadly rounded; sensilla flagelliform, ciliate in distal 2/3, positioned before the level of PL; f_1 before S_1; f_2 behind S_2. Standard measurements: AW 77, PW 92, SB 32, ASB 27, PSB 28, SD 55, P-PL 24, AP 27, AM 40, AL 41, PL 46, H 43, D_{min} 32, D_{max} 40, V_{min} 31, V_{max} 38, pa 283, pm 247, pp 272, TaIIIL 69, TaIIIW 16, dmt 13.

The specimen in question undoubtedly belongs to the species group *vulgaris*, whose distinctive features include the smooth galeal seta, fPp = B/B/NN(b)B, 3 genualae I, the presence of 4 humeral setae, and a peculiar arrangement of the second row of dorsal idiosomal setae, at the ends of which there are 2 series of 3 setae each, oriented almost longitudinally but with anterior ends inclined medially (Stekolnikov, 1999). Considering the results of later studies, this group includes nine species: *Neotrombicula vulgaris* (Ukraine, Poland, Hungary, Bulgaria, Moldova, Georgia, Azerbaijan, Turkey, Israel, Turkmenistan, China; Russia: Stavropol Territory, Krasnodar Territory, North Ossetia), *N. absoluta* Schluger, 1966 (Ukraine: Transcarpathian Region), *N. baschkirica* Kudryashova, 1998 (Bashkortostan and Chuvash republics, Kirov Province, Komi Republic, Tyumen Province), *N. kharadovi* Kudryashova, 1998 (Kyrgyzstan, Kazakhstan, Uzbekistan, Tajikistan; Russia: Altai Territory), *N. aideriensis* Stekolnikov, 1999 (Turkmenistan), *N. macrovulgaris* Stekolnikov, 1999 (Karachay-Cherkessia), *N. kounickyi* Daniel et Stekolnikov, 2009 (Nepal), *N. palestinensis* (Radford, 1957) (Israel), and *N. kizlarsivrisiensis* Stekolnikov et Daniel, 2012 (Turkey).

Collection localities of the chigger mite species group *Neotrombicula vulgaris* (Schluger, 1955).

The collection localities from which we have studied material of the species group *vulgaris* are shown in the map (figure). The range of the nominotypical species of the group is probably smaller than that described above, because part of the material from Europe outside Russia may in fact belong to *N. absoluta*, and the material from China, to *N. kharadovi*.

The specimen from the vicinity of Kurgolovo most closely resembles *N. absoluta* in the values of the quantitative characters, but it differs from the two examined syntypes of the latter species in a smaller number of idiosomal setae (NDV = 88 vs. 115–129), a smaller length of these setae (H = 43 vs. 45–56, D_{min} = 32 vs. 37–38, D_{max} = 40 vs. 48–52, V_{min} = 31 vs. 32–34, V_{max} = 38 vs. 44–46), and also in shorter AM (40 vs. 49) and PL (46 vs. 49–53). Our specimen differs from another geographically close species, *N. baschkirica*, in noticeably shorter setae (AM = 40 vs. 41–55, PL = 46 vs. 50–64, H = 43 vs. 51–62, D_{min} = 32 vs. 36–46, D_{max} = 40 vs. 50–59, V_{max} = 38 vs. 43–55) and a shorter scutum (ASB = 27 vs. 31–36 and SD = 55 vs. 58–68).

As can be seen from the above, in the measurements of setae our specimen more strongly differs from *N. baschkirica* than from *N. absoluta*. Besides, in our opinion, its difference from *N. baschkirica* in the shape (proportions) of the scutum is more significant taxonomically than its difference from the type series of *N. absoluta* in the number of idiosomal setae. Finally, the Kurgolovo specimen resembles *N. absoluta* in the arrangement of the first row of dorsal idiosomal setae. This row is double (10 + 4) in our specimen and in the syntypes of *N. absoluta*, whereas such a pattern is never found in *N. baschkirica*. Thus, we can tentatively identify the specimen from Leningrad Province as *N. absoluta*. Examination of additional material may give grounds for describing the Kurgolovo form as a distinct species or, on the contrary, it may reveal gradual transition between this form and close species of the group *vulgaris*.

A question arises, why only a single specimen of *Neotrombicula* has been found among several hundred thousand specimens of *Hirsutiella zachvatkini* collected for many years in three adjacent provinces of Russia. In our opinion, the species composition of the collected chigger mites is largely determined by the fact that material has been mostly collected in the forest. It is known that under the conditions of Eastern Europe, *H. zachvatkini* is a forest species while mites of the genus *Neotrombicula* prefer open biotopes (Daniel, 1961). Since mass material of rodent ectoparasites can be more easily obtained in the forest, researchers have not felt it necessary to cover the whole diversity of biotopes during routine stationary eco-parasitological studies. In view of this, carrying out collections in naturally treeless territories, such as flood plains of large rivers or coastal areas, would be most promising. It may be no coincidence that the Kurgolovo specimen of *Neotrombicula* was collected only 0.6 km from the Gulf of Finland coast.

It should be noted that one more species of this genus, *Neotrombicula* (*Digenualea*) *uliginosa* Kudryashova, 1998, is widely distributed in the north of European Russia: it was collected in Murmansk and Arkhangelsk provinces and in many localities in the northwest of the Komi Republic (Kudryashova, 1998). As noted above, *N. baschkirica* was also found in the Komi Republic. It is evident that these or other species of *Neotrombicula* are also likely to occur in other parts of the Northwestern Federal District of Russia.

ACKNOWLEDGMENTS

Material collection in 2006 was financially supported by the Russian Foundation for Basic Research (project 05-04-48468-a: “Differentiation of ecological niches of acarines and insects in ectoparasite communities of forest rodents and insectivores”).

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