Morphological diversity of *Neotrombicula kharadovi* Kudryashova, 1998 (Acariformes, Trombiculidae)

A. V. Kharadov
Institute of Biology and Soil Sciences, Tchui Prospekt 265, Bishkek, 720071, Kyrghyzstan

Introduction

Morphological diversity is peculiar to all the living organisms and represents an integral part of the evolutionary process. At the change of the habitats the morphological diversity creates the necessary prerequisites to improve the specific hereditary plasticity; at the same time it improves the adaptive potential that is necessary when spreading into new climatic zones. Apparently, under the certain conditions the further fixing of the modified morphological structures could take place. The examination of the morphological divergence is important in a practical sense because it gives the possibility to identify the species more preciously.

The chigger mites (Acariformes, Trombiculidae) belong to the vast family including about 3000 species (Brennan, Goff, 1977). At present, 246 species representing 42 genera and 4 subfamilies are found within the territory of the ex-USSR (Kudryashova, 1998). Many species of the chigger mites are of a certain medical and veterinary importance; the chigger mites' bites entail the trombidioses; besides, a number of species belongs to the carriers of the tsutsugamushi fever agents.

Among the chigger mites the morphological diversity has been studied in few studies only (Sasa, 1958; Wen, Jen, 1959; Goksu et al., 1960; Wang, 1985; Stekolnikov, 2001; Kharadov, Chirov, 2001).

N. (*N.*) *kharadovi* Kudryashova, 1998 was found in Kazakhstan and Tajikistan; it was observed feeding on six host species. The larvae were described being taken in August, in Osh Region, Kyrghyzstan, from *Apodemus silvaticus* L. (Kudryashova, 1998).

Within Kyrghyzstan this species was occurred on 13 vertebrate species belonging to the insectivorous mammals, rodents, predators and birds. The main host species of them are, most probably, forest and field mice, and musk rat since the most part (94.0%) of *N.* (*N.*) *kharadovi* specimens was collected from the mentioned rodent species. The mites' attacks were observed from March till November, but the most number of them is confined to autumn. Thus, within Tokmak hunting area in September the occurrence index in the common forest mouse was 61.2%, the invasion intensiveness – 6.2 mites; under the same conditions in the field mouse the corresponding indexes were 47.3% and 12.2 mites, in the musk rat – 83.3% and 16.6 mites, respectively. The maximal number of larvae registered in October on the forest mouse is 86 specimens inhabiting the same animal. Taken in all, 632 specimens of *N. kharadovi* were collected from 89 host animals; in surroundings of Tokmak the species was occurred being confined to waterlogged areas. Presumably, *N. kharadovi* could be recognized to be a hygrophilous species; it was rarely occurred in montane regions.

Material and methods

Objects of the present study represent the morphological structures of 632 larvae of *N. kharadovi* collected in different regions of Kyrghyzstan. The mites were occurred in the following localities: Chu River Valley – surroundings of Tokmak; Kyrghyzskiy Mt. Ridge – Ala-Archa, Erkin-Sai; Kungei Mt. Ridge – Baisorun; Keolu Mt. Ridge – Sary-Golot; Chatkal Mt. Ridge – Sary-Chelek Reserve; Issyk-Kul depression – Boom canyon, Ottuk, Kara-Bulun, Chon-Urukty, Semenovka. The most part of the larvae (83.3%) was collected in the first locality.

Mite specimens with modified morphological structures were occurred from 14 species of rodents belonging to five species: *Cricedura snaveoleus* Pallas, 1811, *Dryomys nitedula* Pallas, 1973, *Apodemus silvaticus* Linnaeus, 1758, *A. agrarius* Pallas, 1771, *Microtus kirgisorum* Ognev, 1950.

The field collecting of mites and preparations in-vitro were done in the accordance with the adopted methods (Zhovtyi, Schluger, 1957; Hushcha, 1961). Morphological structures were studied with microscope MBI-6 and transparent light. The drawings were made with the drawing projector RA-7 provided with objective lens 9Ч, 40Ч, 60Ч and ocular lens 7Ч and 12Ч. Abbreviations and diagnostic formulae of the morphological structures are given according to the terminology accepted in taxonomy of the chigger mites (Goff et al., 1982).

Material used in the study is deposited in collection of the Laboratory of parasitology, Institute of Biology and Soil Sciences, Kyrghyz NAS (Bishkek).

Terminology

A concrete definition of the terms *variation* (*aberration*) and *anomaly* was offered in the previous study (Kharadov, Chirov, 2001). Later, while reviewing some morphological deviations we had occasion to use the following terms.

Type. Corresponds to variability of the same structure representing by one (and more then one) form (Fig. 7, B, a, b); type *a* - fSt=3 possesses the only form whereas type *b* - fSt=5 does three ones.

Form. Designates one or few different aberrations of the same structure possessing the same base (*type*) but varying throughout (Fig. 7, B, 1, 2, 3).

Complex. Corresponds to variability of two (or more) structures in the same mite specimen (ga+DS).

The observed divergences and their complexes were united into five groups: A – atypical forms including all the noted divergences; B – asymmetrical variability of one structure in the mite only (ga = 2.3); C – symmetric variability of one structure (fCx = 1.1.2); E – independent asymmetric variability of 2 structures (ga + DS); F – dependent asymmetric variability of 2 structures (fCx + fSt).

Results and discussion

The morphological diversity has been found in 50 larvae of *N. kharadovi* (7.9 % of the material examined). In the course of examination they were referred to 27 basic aberrant forms, 3 anomaly forms; taken as in the whole they touched on 8 morphological structures.

Idiosoma (Fig. 1). The body size in the mites after feeding could be expanded much times more (Vercammen-Grandjean, 1958). According to our data the length of the idiosoma in the full specimens of *N. kharadovi* could be enlarged 2,4 times more. The hungry larvae have rounded form, anomal idiosomatic forms have been observed in the full specimens only. The typical form of the idiosoma in the full mites is oval (Fig. 1, A). Two anomaly forms are found (Fig. 1, B): oval type possessing the angularly rounded edges and another one with rounded and enlarged shoulder part (Fig. 1, B, 1, 2). A number of species with the noted anomaly types: 1 – 1L, 2 – 1L.

Dorsal scutum (Fig. 2). The abnormal structure of two larvae was found in two larvae (Fig. 2, B).

Anteromedian (AM) scutal seta (Fig. 3). Five larvae were observed lacking AM (Fig. 3, B).

Posterolateral (PL) scutal setae (Fig. 4). This group unites the aberrant forms possessing few postposterolateral setae (PPL) located on the scutum, with thecae disposed both side-by-side and one over another (Fig. 4, B, 1, 2). The absence of one of PL, combined with reduction of the corresponding scutal corner (Fig. 4, B, 3). A number of the specimens possessing the deviations of the each mentioned type is: 1 – 1L, 2 – 1L, 3 – 2L.

Shoulder (H) setae (Fig. 5). Aberrations of the shoulder setae are found in 9 specimens; they are represented by the only type H = 5 with three topographic forms (Fig. 5, B, 1, 2, 3). A number of the specimens possessing the deviations of the each is: 1 – 6L, 2 – 1L, 3 – 2L.

Dorsal setae (DS) of the idiosoma. No any significant anomalies in disposition of the setae was observed except some variations in the setae number varying from 4H.8.10.10... till 4H.11.13.13...

Coxal (fCx) setae (Fig. 6). Aberrations of the coxal setae were found to be represented by three asymmetrical types; a symmetrical setae topography was observed only once (Fig. 6, B, 1, 2, 3, 4). An acquisition of the additional setae caused a loss of the nearest sternal seta; in those cases then the corresponding seta was lost on the coxa it was accompanied by its acquisition close to the mentioned srernal seta. A number of the specimens with deviations of the each type is: 1 – 1L, 2 – 1L, 3 – 2L, 4 – 1L.

Sternal (fSt) setae (Fig. 7). Two aberrant types connected with different number of the setae and 4 topographic forms are noted (Fig. 7, B, 1, 2, 3). It should be noted that no any deviations in the setae position were noted for type fSt = 2.2. A number of the aberrations of the each type is: a – 2L, b – 3L.

Patellar solenidia (ga) of I leg pair (Fig. 8). Aberrations of the solenidia are grouped into three types; they are represented by 9 topographic forms. The most number of forms (4) is noted for types ga = 2 and ga = 3. A number of the specimens with deviations of the each type is: a – 10L, b – 5L, c – 1L.

In *N. kharadovi* 8 morphological structures were found in the course of the study to be the subjects of modifications. Most often the aberrations of the patellar solenidia (ga) of I leg pair were occurred – 34.8 %; aberrations of the shoulder setae (H) took the second place – 19.6 %, those of the coxal setae (fCx) did the third place – 15.2 %. Any anomalies that were found touched on the idiosoma and the scutum only (Table 1). Among 50 specimens possessing the deviations, the share of aberrations was 92.0 %, the same for anomalies was 8.0 %. 27 different forms of deviations forms are divided between aberrations (88.9 %) and anomalies (11.1 %).

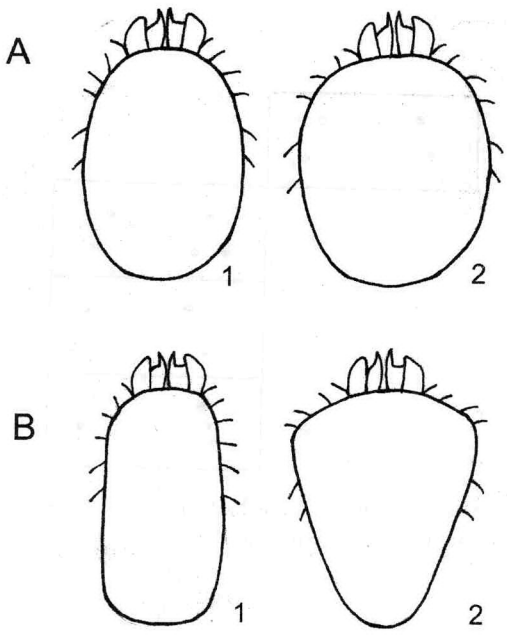

Fig. 1. Shapes idiosoma *Neotrombicula kharadovi*: A – typical; B - anomalous.

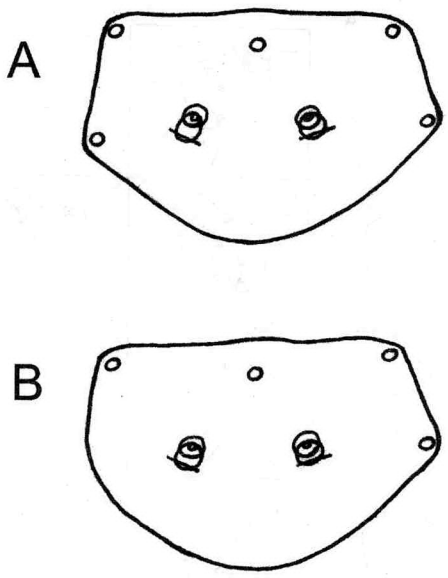

Fig. 2. Shapes of scutum: A – typical; B - anomalous.

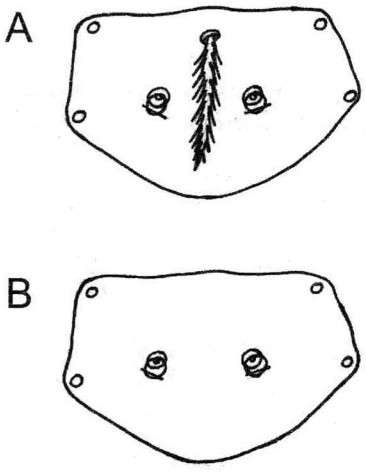

Fig. 3. Anteromedial chaeta of scutum (AM): A - typical shape; B - aberration.

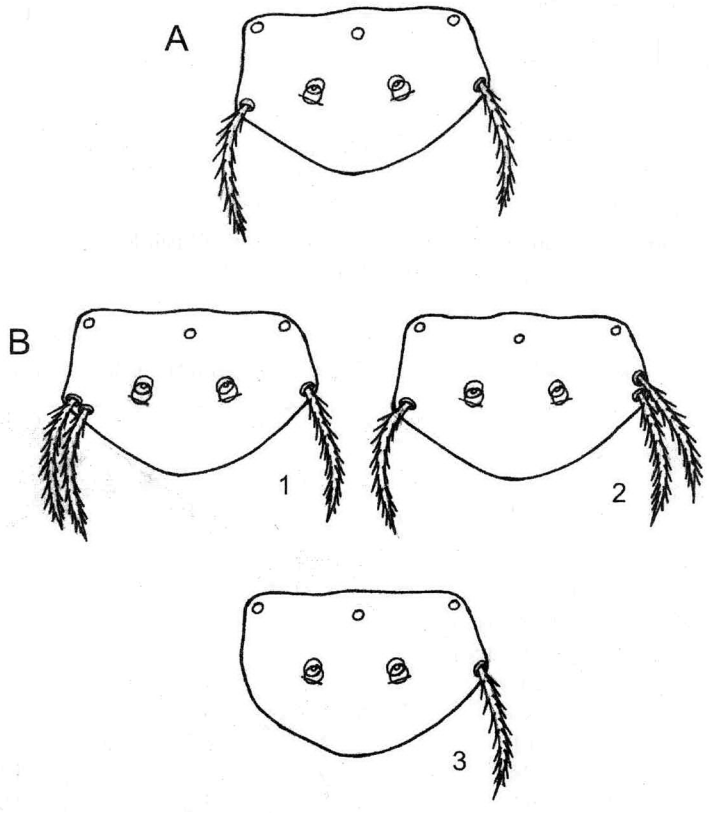

Fig. 4. Posterolateral chaetes of scutum (PL): A. - typical shape; B – aberrations.

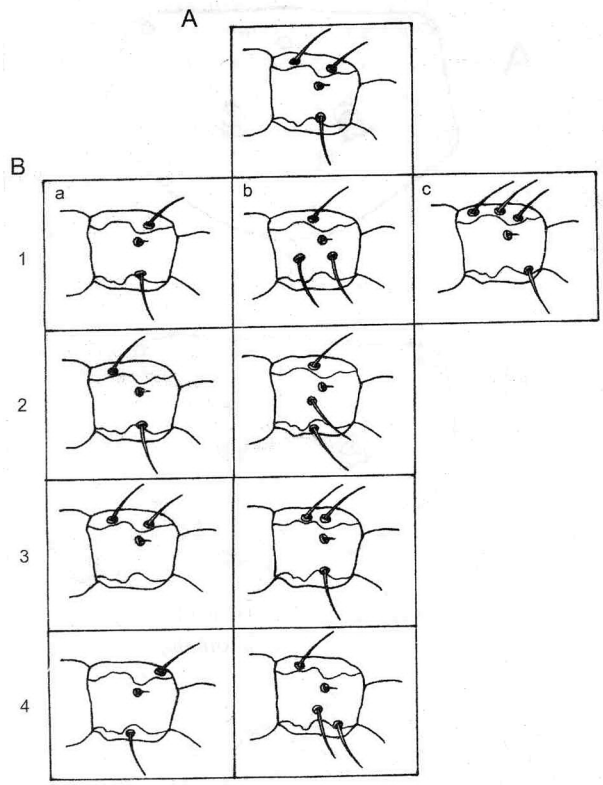

Fig. 8. The arrangement of solenidies of genu of I pair legs (ga):A - typical; B – aberrant.

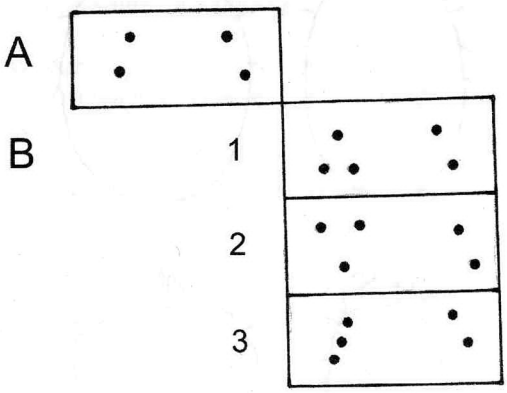

Fig. 5. The arrangement of brachial cbaetes (H): A - typical; B – aberrant.

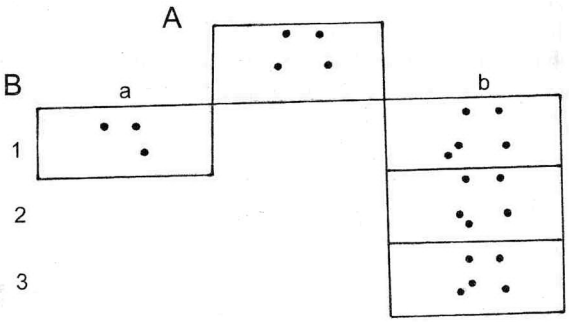

Fig. 7. The arrangement of sternal chaetes (fSt): A - typical; B - aberrant.

Table 1. The observed level of variability for the chigger mite *Neotrombicula kharadovi.*

Structures	Occurred							
	specimens with aberrations	%	types with aberrations	%	specimens with anomalies	%	types with anomalies	%
Shape of idiosoma	–	–	–	–	2	50.0	2	66.7
Shape of scutum	–	–	–	–	2	50.0	1	33.3
Setae:								
AM	5	10.9	1	4.3	–	–	–	–
PL	4	8.7	3	12.5	–	–	–	–
H	9	19.6	3	12.5	–	–	–	–
fCx	7	15.2	4	16.6	–	–	–	–
fSt	5	10.8	4	16.6	–	–	–	–
ga	16	34.8	9	37.5	–	–	–	–
Total:	46	100.0	24	100.0	4	100.0	3	100.0

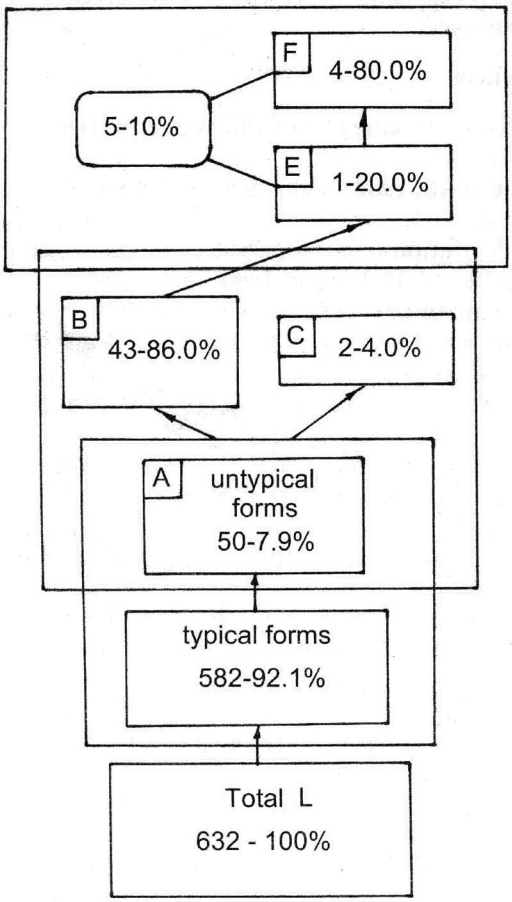

Fig. 9. The structure of morphological declinations in *Neotrombicula kharadovi* mites.

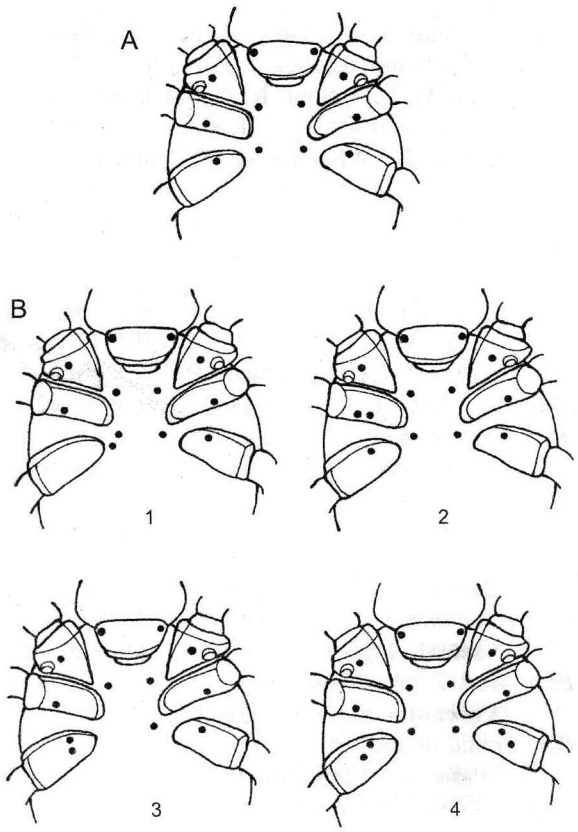

Fig. 6. The arrangement of coxal chaetes (fCx):A - typical; B - aberrant.

Table 2. The morphological diversity complexes in the chigger mite *Neotrombicula kharadovi.*

Complexes	Groups					
	C		E		F	
	number of complexes	%	number of complexes	%	number of complexes	%
Shape of the scutum + PL	–	–	–	–	2	50.0
fCx + fSt	–	–	–	–	2	50.0
fCx = 1.1.2	1	50.0	–	–	–	–
ga = 2.2	1	50.0	–	–	–	–
ga + DS	–	–	1	100.0	–	–
Total:	2	100.0	1	100.0	4	100.0

Three groups of the morphological complexes were uncovered (Table 2). Ratio of C, E, F groups amounts to 28.6 %, 14.3 %, 57.1 %, respectively. The structure of complexes taken into consideration show that the typical forms amount 92.1 % of the total number; groups B and C, group complexes E plus F amount 86.0 %, 4.0 % and 10.0 % of the atypical forms (Fig. 9). Morphological diversity in *N. kharadovi* took place in 7.9 % of the examined specimens.

References

Brennan J. M., Goff M. I., 1977. Keys to the genera of chiggers of the Western Hemisphere. (Acarina: Trombiculidae). *J. Parasitol., 63(3):554-566.*

Goff M. L., Loomis R. B., Welbourn W. C., Wrenn W. J., 1982. A glossary of chigger termiology (Acari: Trombiculidae). *J. Med. Entomol., 19(3):221-238.*

Goksu K., Wharton G. W., Yunker C. E., 1960. Variation in populations of laboratory-reared *Trombicula (Leptotrombidium) akamushi* (Acarina: Trombiculidae). *Acarologia, 2:199-209.*

Hushcha G. I., 1961. Methods of collecting and examination of the chigger mites (trombiculids). *Methods of the parasitological survey and combating against the parasites of farm animals. Kiev:182-192* [in Russian].

Kharadov A. V., 1996. Three new species of chigger mites (Acariformes, Trombiculidae) from Kyrghyzstan. *Izv. NAN Kyrg., 1:47-49* [in Russian].

Kharadov A. V., Chirov P. A., 2001. Morphological variability in *Neotrombicula monticola* Shluger et Davidov, 1967 (Acariformes, Trombiculidae). *Entomol. and parasitol. issled. in Povolzh'e. Saratov, 1:70-82* [in Russian].

Kudryashova N. I., 1998. The chigger mites (Acariformes, Trombiculidae) of the East Palaearctic. *Proc. Zool. Muz. Moscow Univ., 39:1-342* [in Russian].

Stekolnikov A. A., 2001. Intraspecific variability of the chaetotaxy in the chigger mite genus *Hirsutiella* (Acari: Trombiculidae). *Parasitologia,35(1):19-26* [in Russian].

Zhovtyi I. F., Schluger E. G., 1957. Methods of collecting the chigger mites. *Izv. Irkutsk. Protivotchumn. In-ta Sib. Dal. Vost., 16:177-187* [in Russian].

Sasa M., 1958. Comparative studies on the leg chaetotaxy of larval trombiculid mites of Japan. *J. Exp. Med.,28(1):11-34.*

Vercammen-Grandjean R.H., 1958. Revision du genre Schoutedenichia Jad. et Verc. *Ann. Mus. Roy. Congo Belge. Ser. Sci. Zool., 65:1-103.*

Wang D., 1985. Studies on the moustrosities of trombiculid larvae. *Acta Entomol. sinica, 28(4):437-443* [in Chinese].

Wen T.W., Jen M.H., 1959. The chicken chigger mite Neoschoengastia gallinarum (Haroti, 1920) and its scutal variations (Acariformes: Trombiculidae). *Acta Primae Secundae Acad. Med. Shanghai, 3:233-244* [in Chinese].

Summary

Харадов А.В. **Морфологическая изменчивость *Neotrombicula kharadovi* Kudryashova, 1998 (Acariformes, Trombiculidae)**

Изучены морфологические структуры 632 личинок *N. kharadovi,* собранных во время экспедиций в различных урочищах Кыргызстана. Клещи обнаружены в Чуйской долине Особи с морфологической изменчивостью обнаружены на 14 животных, относящихся к пяти видам: белозубка малая *Cricedura snaveoleus* Pallas, 1811, лесная соня *Dryomys nitedula* Pallas, 1773, лесная мышь *Apodemus sylvaticus* Linnaeus, 1758, полевая мышь *A. agrarius* Pallas, 1771, киргизская полевка *Microtus kirgisorum* Ognev, 1950. Собранный материал хранится в коллекции лаборатории паразитических членистоногих Биолого-почвенного института НАН Кыргызстана (Бишкек).