

## Supplementary material

Table S1. Sources of information on fleas and small mammals from the 49 regions used in the analyses.

Region	Source
Adzharia, southern Caucasus	Alania et al. 1964
Akmolinsk region, northern Kazakhstan	Mikulín 1959a
Altai mountains, Russia	Sapegina et al. 1981a
Amur river valley, southern Russian Far East	Koshkin 1966
Azerbaijan, Caucasus	Kunitsky and Kunitskaya 1962
Central California	Linsdale and Davis 1956
Southwestern California	Davis et al. 2002
Central Yakutia, Russia	Elshanskaya and Popov 1972
Colorado	Campos et al. 1985
Connecticut	Main 1983
Dzhungarskiy Alatau ridge, Kazakhstan	Burdelova 1996
East Balkhash desert, Kazakhstan	Mikulín 1959b
Eastern Pamir mountains	Morozkina et al. 1970, Ageev and Sludsky 1985
Gissar ridge, Tajikistan	Morozkina et al. 1971
Idaho	Allred 1968
Kabarda, northern Caucasus	Syrvacheva 1964
Kamchatka peninsula, eastern Russian Far East	Paramonov et al. 1966
Khasan lake region, southernmost Russian Far East	Leonov 1958
Korea	Walton and Hong 1976
Krasnojarsk region, central Siberia	Ravkin and Sapegina 1990
Kurgan region, southern Ural mountains	Starikov and Sapegina 1987
Kustanai region, northwestern Kazakhstan	Reshetnikova 1959
Mongolia, central Khangay	Vasiliev 1966
Mongolia, northwestern Khangay	Labunets 1967
Moscow region, central European Russia	Darskaya et al. 1970
Moyynkum desert, southern Kazakhstan	Popova 1968
Negev Desert	Krasnov et al. 1997
New Mexico	Morlan 1955
Magadan and Tchukotka region, northern Russian Asian Far East	Yudin et al. 1976
Northern Kyrgyzstan, Kyrgyz ridge	Shwartz et al. 1958
Novosibirsk region, southern Siberia	Violovich 1969
Pre-PolarUral mountains	Novozhilova 1977
Scotland	Varma and Page 1966
Selenga region, central Siberia	Pauller et al. 1966
Shymkent region, southern Kazakhstan	Nuriev et al. 2004.
Slovakia	Stanko et al. 2002
Sugaty valley, southern Kazakhstan	Sabilaev et al. 2003
Sweden	Brinck 1966
Taimyr peninsula, northern Siberia	Sapegina et al. 1980a, 1981b
Tarbagatai ridge, eastern Kazakhstan	Mikulín 1958
Tomsk and Tumen, western Siberia	Sapegina et al. 1980b
Turkmenistan	Zagniborodova 1960
Tuva	Letov et al. 1966
Ural river Valley, eastern Siberia	Tanitovskiy et al. 2004
Ussury river valley, southern Russian Far East	Kozlovskaya 1958
Volga-Kama region, Russia	Nazarova 1981

## References

- Ageev, V. S. and Sludsky, A. A. 1985. Materials on fleas of small mammals in the eastern Pamir and perspective of the epizootologic monitoring of this region. – In: Taran, I. F. (ed.), Important questions of epidemiological monitoring in the natural foci of plague. Natural focality of plague in high mountains. Sci. Anti-Plague Inst. Caucasus Trans-Caucasus, pp. 10–12, in Russian.
- Alania, I. I. et al. 1964. Data on the flea fauna of Adzharia. – Proc. Armenian Anti-Plague Station 3: 407–435, in Russian.
- Allred, D. M. 1968. Fleas of the National Reactor Testing Station. – Great Basin Nat. 28: 73–87.
- Amin, O. M. 1976. Host associations and seasonal occurrence of fleas from southeastern Wisconsin mammals with observations on morphologic variations. – J. Med. Entomol. 13: 179–192.
- Anderson, S. H. and Williams, E. S. 1997. Plague in a complex of white-tailed prairie dogs and associated small mammals in Wyoming. – J. Wildl. Dis. 33: 720–732.
- Brinck, G. 1966. Siphonaptera from small mammals in natural foci of tick-borne encephalitis virus in Sweden. – Opusc. Entomol. 31: 156–170.
- Burdelova, N. V. 1996. Flea fauna of some small mammals in Dzhungarskiy Alatau. – In: Burdelov, L. A. (ed.), Proceeding of the conference “Ecological aspects of epidemiology and epizootology of plague and other dangerous diseases”. Almaty, pp. 119–120, in Russian.
- Campos, E. G. et al. 1985. Seasonal occurrence of fleas (Siphonaptera) on rodents in a foothills habitat in Larimer County, Colorado, USA. – J. Med. Entomol. 22: 266–270.
- Darskaya, N. F. et al. 1970. On fleas of the common vole and shrews in dependence on sharp density fluctuations of these mammals. – In: Tiflov, V. E. (ed.), Vectors of particularly dangerous diseases and their control. Sci. Anti-Plague Inst. Caucasus Trans-Caucasus, pp. 132–152, in Russian.
- Davis, R. M. et al. 2002. Flea, rodent and plague ecology at Chichupate Campground, Ventura County, California. – J. Vector Ecol. 27: 107–127.
- Elshanskaya, N. I. and Popov, M. N. 1972. Zoologico-parasitological characteristics of the river Kenkeme valley (central Yakutia). – In: Kolosova, L. D. and Lukyanova, I. V. (eds), Theriology, Vol. 1. Nauka, Siberian Branch, pp. 368–372, in Russian.
- Emelyanova, N. D. and Shtilmark, F. R. 1967. Fleas of insectivores, rodents and lagomorphs of the central part of Western Sayan. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 27: 241–253, in Russian.
- Koshkin, S. M. 1966. Materials on flea fauna in Sovetskaya Gavan. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 26: 242–248, in Russian.
- Kozlovskaya, O. L. 1958. Flea (Aphaniptera) fauna of rodents from of the river Ussury valley in the Khabarovsk region. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 17: 109–116, in Russian.
- Krasnov, B. R. et al. 1997. Host-habitat relation as an important determinant of spatial distribution of flea assemblages (Siphonaptera) on rodents in the Negev Desert. – Parasitology 114: 159–173.
- Kunitsky, V. N. and Kunitskaya, N. T. 1962. Fleas of the southwestern Azerbaijan. – Proc. Azerbaijanian Anti-Plague Station 3: 156–169, in Russian.
- Labunets, N. F. 1967. Zoogeographic characteristics of the western Khangay. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 27: 240–341, in Russian.
- Leonov, Y. A. 1958. Fleas parasitic on rodents of the southern part of Primorye (Far East). – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 17: 147–152, in Russian.
- Letov, G. S. et al. 1966. Rodents and their ectoparasites in the settlements of Tuva. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 26: 270–276, in Russian.
- Linsdale, J. M. and Davis, B. S. 1956. Taxonomic appraisal and occurrence of fleas at the Hastings Reservation in central California. – Univ. California Publ. Zool. 54: 293–370.
- Main, A. J. 1983. Fleas (Siphonaptera) on small mammals in Connecticut, USA. – J. Med. Entomol. 20: 33–39.
- Mikulin, M. A. 1958. Data on fleas of the Middle Asia and Kazakhstan. 5. Fleas of the Tarbagatai. – Proc. Middle Asian Sci. Anti-Plague Inst. 4: 227–240, in Russian.
- Mikulin, M. A. 1959a. Data on fleas of the Middle Asia and Kazakhstan. 10. Fleas of the eastern Balkhash desert, Trans-Alakul desert and Sungorian Gates. – Proc. Middle Asian Sci. Anti-Plague Inst. 6: 205–220, in Russian.
- Mikulin, M. A. 1959b. Data on fleas of the Middle Asia and Kazakhstan. 8. Fleas of the Akmolinsk region. – Proc. Middle Asian Sci. Anti-Plague Inst. 5: 237–245, in Russian.
- Morlan, H. B. 1955. Mammal fleas of Santa Fe County, New Mexico. – Texas Rep. Biol. Med. 13: 93–125.
- Morozkina, E. A. et al. 1970. Materials on the ecology of fleas of the red marmot in the eastern Pamir. – In: Tiflov, V. E. (ed.), Vectors of particularly dangerous diseases and their control. Sci. Anti-Plague Inst. Caucasus Trans-Caucasus, pp. 337–341, in Russian.
- Morozkina, E. A. et al. 1971. Fleas of the red marmot (*Marmota caudata*) and other animals inhabiting the Gissar ridge. – Problems of Particularly Dangerous Infections (The Works of Anti-Plague Establishments) 1: 38–44, in Russian.
- Nazarova, I. V. 1981. Fleas of the Volga-Kama region. – Nauka, in Russian.
- Novozhilova, E. N. 1977. Ectoparasites of small mammals and inhabitants of their burrows in the Pre-Polar Ural. – Proc. Komi Branch Acad. Sci. USSR 34: 125–139, in Russian.
- Nuriev K. K. et al. 2004. Materials on rodents’ fleas from mountain regions of South Kazakhstan. – Quarantinable and Zoonotic Infections in Kazakhstan 9: 66–70, in Russian.
- Paramonov, B. B. et al. 1966. Materials for the study of ectoparasites of rodents and shrews of the Kamchatka peninsula. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 26: 333–341, in Russian.
- Pauller, O. F. et al. 1966. Ecological and faunistic review of mammalian and bird ectoparasites in the tularemia focus of the Selenga river delta. – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 26: 322–332, in Russian.
- Popova, A. S. 1968. Flea fauna of the Moyynkum desert. – In: Fenyuk, B. K. (ed.), Rodents and their ectoparasites. Saratov Univ. Press, pp. 402–406, in Russian.
- Ravkin Y. S. and Sapegina, V. F. 1990. Fleas of rodents of the southern taiga of Priangarje. – Bull. Siberian Br. Acad. Sci. USSR, Ser. Biol. Sci. 3: 63–68, in Russian.
- Reshetnikova, P. I. 1959. Flea fauna of the Kustanai region. – Proc. Middle Asian Sci. Anti-Plague Inst. 6: 261–265, in Russian.
- Sabilaev, A. S. et al. 2003. About rodents’ flea fauna on the left bank of the Ili river. – Quarantinable and Zoonotic Infections in Kazakhstan 7: 148–149, in Russian.
- Sapegina, V. F. et al. 1980a. Materials on the biology of fleas of Taimyr and Gydanskiy peninsulæ. – In: Davydova, M. S. (ed.), Parasitic insects and ticks of Siberia. Nauka, Siberian Branch, pp. 225–231, in Russian.
- Sapegina, V. F. et al. 1980b. Fleas of the forest zone of western Siberia. – In: Belyshev, B. F. and Ravkin, Y. S. (eds), Problems of zoogeography and faunal history. Nauka, Siberian Branch, pp. 94–166, in Russian.
- Sapegina, V. F. et al. 1981a. Fleas of small mammals in northern foothills of Altai Mountains and Upper Ob river region. – In: Maximov, A. A. (ed.), Biological problems of natural foci. Nauka, Siberian Branch, pp. 167–176, in Russian.
- Sapegina, V. F. et al. 1981b. Fleas of small mammals in the northern taiga of the southern Taimyr peninsula. – Bull. Siberian Br. Acad. Sci. USSR, Ser. Biol. Sci. 1: 96–104, in Russian.

- Shwartz, E. A. et al. 1958. Fleas of rodents of the Frunze region. – Proc. Middle Asian Sci. Anti-Plague Inst. 4: 255–261, in Russian.
- Sineltshikov, V. A. 1956. Study of flea fauna of the Pavlodar region. – Proc. Middle Asian Sci. Anti-Plague Inst. 2: 147–153, in Russian.
- Stanko, M. et al. 2002. Mammal density and patterns of ectoparasite species richness and abundance. – *Oecologia* 131: 289–295.
- Starikov, V. P. and Sapegina, V. F. 1987. Ectoparasites of small mammals of forest-steppes Zauralje. – In: Tcherepanov, A. I. (ed.), Ecology and geography of arthropods in Siberia. Nauka, Siberian Branch, pp. 76–83, in Russian.
- Syrvacheva, N. G. 1964. Data on the flea fauna of Kabardino-Balkarian ASSR. – Proc. Armenian Anti-Plague Station 3: 389–405, in Russian.
- Tanitovskiy, V. A. et al. 2004. Species structure and number of fleas parasitizing small mammals in the middle part of the Ural River valley. – Quarantinable and Zoonotic Infections in Kazakhstan 9: 76–80, in Russian.
- Varma, M. G. R. and Page, R. J. C. 1966. The epidemiology of louping ill in Ayrshire, Scotland: ectoparasites of small mammals. I. (Siphonaptera). – *J. Med. Entomol.* 3: 331–335.
- Vasiliev, G. I. 1966. On ectoparasites and their hosts in relation to the plague epizootic in Bajan-Khongor aimak (Mongolian People Republic). – Proc. Irkutsk State Sci. Anti-Plague Inst. Siberia Far East 26: 277–281, in Russian.
- Violovich, N. A. 1969. Landscape and geographic distribution of fleas. – In: Maximov, A. A. (ed.), Biological regionalization of the Novosibirsk Region. Nauka, Siberian Branch, pp. 211–221, in Russian.
- Walton, D. W. and Hong, H. K. 1976. Fleas of small mammals from the endemic haemorrhagic fever zones of Kyonggi and Hangwon provinces of the Republic of Korea. – *Korean J. Parasitol.* 14: 17–24.
- Yudin, B. S. et al. 1976. Small mammals of the northern Far East. – Nauka, Siberian Branch, in Russian.
- Zagniborodova, E. N. 1960. Fauna and ecology of fleas on the western Turkmenistan. – In: Fenyuk, B. K. (ed.), Problems of natural nidi and epizootology of plague in Turkmenistan. Turkmenian Anti-Plague Station and All-Union Sci. Anti-Plague Inst. “Microb”, pp. 320–334, in Russian.