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Current State of Ixodidae Research in Mongolia

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Current State of Ixodidae-research in Mongolia

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Abstract

Our research presents the Ixodidae-fauna in Mongolia. The current taxonomic state in Mongolia shows 19 Ixodidae taxa extracted in 308 locations from 115 bird and mammal species. In 1980, the species *Ixodes persulcatus* SCHULZE, 1930 and *Ixodes berlesei* Birula, 1895 were detected in Inget Tolgoi and *Ixodes laguri* OLENEV, 1929 on *Meriones unguiculatus* 10 km southeast of Ulaanbaatar for the first time. In 2000 the species *Haemaphysalis concinna* Koch, 1844 was detected in the Selenge-river area and *Argas* (*Argas*) *vulgaris* FILIPPOVA, 1961 was detected in the Gobi area. From the collection of M. and A. STUBBE 1 N (Nymphae) *Ixodes persulcatus* was detected on *Microtus* sp. at the Minž-gol (river in Khentey) on 25.07.2002.

Keywords: Ixodidea, Mongolia, Aves, Mammalia, ecology, distribution, medical importance,

1. Introduction

In the publication Argasidae and Ixodidae in Mongolia present and perspective KIEFER et al. (2007) we mentioned tick-species registered in Mongolia as well as tick-species we assume to occur in the south-western part of Mongolia bordering to China and Kazachstan and in the northern areas of Mongolia in reference to the data from the 70s, 80s and later publications. It concerns *Dermacentor asiaticum*, EMELYANOVA, KOZLOVSKAYA, 1967; *Haemaphysalis demidovae* EMELYANOVA, 1978; *Ixodes prokopyevi* EMELYANOVA, 1979; *Ixodes persulcatus* SCHULZE, 1930; *Ixodes berlesei* Birula, 1895; *Ixodes laguri* OLENEV, 1929.

In the mentioned publication as well as in the following ones we intend to analyse the distribution of ticks in Mongolia, their parasite-vector relations, dominance in different areas, relations to plant-associations and altitudinal zones.

The inspirations for the mentioned publications on Mongolian ticks are mainly the publications of N.D. Emelyanova from the 70s and 80s who worked her whole life on this topic.

The material from Mongolian - Slowak (Komenius University) expeditions in 1974 -1988, provided by M. DASH and M.S. KIEFER, was analysed in several scientists. STANKO (1980) created his diploma-thesis “Ticks of Mongolia” (Universitas Comeniana Bratislava, Slowak republik). DASH (1986) published his dissertation “Ticks of Mongolia” (Humbolt Universität Berlin, Germany). DASH et al.(1988) published “Ixodidae ticks of Mongolia” in the journal Medicinska parazitologija and in the journal Mh.Vet.-Med .VEB Gustav Fischer, Jena in 1989. Our current publication is also based on the mentioned material as well as on material from the National Center for Infectious Diseases with Natural Foci Ulaanbaatar, Mongolian-German expeditions since 1962, the Mongolian State University Ulaanbaator, the Mongolian Academy of Sciences and the Moskow State University.

A detailed distribution of ticks in Mongolia is mentioned in the publication of KOLONIN (2009) ‘Fauna of ixodic ticks of the world’.

A huge amount of publications has accumulated from the expeditions of many countries in Mongolia in the last 30-40 years. These publications were published in different languages. This linguistic variety, combined with hindered access to publications is still a grave problem. We´d like to demonstrate this fact on an important group of ectoparasites being important in the agro-veterinarian as well as in the human-medical sector, the Agasidae and Ixodidae in Mongolia.

The data concerning the findings of *Ixodes laguri*, *Ixodes persulcatus* and *Ixodes berlesei* are a good example of the described phenomenon. In many publications, these species aren´t mentioned at all, the finding-date and location are wrong or the host-species is incorrect. Often the nomenclature does not respond the valid, international medical standard (HORAK et al. 2002).

The publication of REHACEK et al. (1982) has to be mentioned at this point. The material, *Dermacentor nuttalli*, was collected along the Selenga river and tested on Rickettsia where as a 77 % prevalence was detected in 1980. This information is very important for the characterisation of this area. In order to avoid further misunderstandings the transmittal of all publications published overseas to the mentioned institutions is crucial. For further reduction of inaccuracies concerning the finding-location, we propose the use of English terms supported by coordinates (E°, N°) as well as Latin names of hosts and parasites in addition to Mongolian terms.

Sample: Mongolian terms and English, Latin terms.

Ulaanbaatar, 106°54' E/47°57' N, *Archaeopsylla sinensis, Erinaceus dauricus*.

Khyalganat, 105°12' E/ 49°24' N, *Ixodes persulcatus, Tetrastes bonasia*.

Where required, these data should be supplemented by the zone and its geobotanic characterisation. As a matter of course a complete check-list and bibliography of the vector-groups has to be created. Discrete vectors have to be revised on a morphological and molecular base.

In this publication we have made a brief entry into the history of tick-research in Mongolia icluding the major research-steps in the great decades of the former and present century.

2. Brief History of tick-research in Mongolia

Ticks belong to the most important vectors. The relevancy of ticks as vectors of diseases with natural foci is based on the following facts. Many pathogenes are able to live for a long period in ticks (possibility of transovarial and transstadial transmission of pathogenes among tick-generations, exchange of ecological host-groups during the development of the tick). Ticks are very specific on their hosts, biotops and therefore areas of distribution, adaptation-ability and often pathogene-transmission.

The beginning of tick-research in Mongolia is connected with the names of well known Russian trawellers at the end of the 19th and the beginning of the 20th century, G.N. POTANIN in the years 1877 and 1899 and P.K. KOZLOV in the years 1901, 1908 and 1926. The collections of these trawellers were analysed by OLENEV, who described *Dermacentor nuttalli* based on this material in 1928. The famous German acarologist P. SCHULZE detected *Dermacentor daghestanicus* in South-Mongolia and *Dermacentor silvarum* at the upper Amur, most probable on Chinese territory.

In the 30ties of the last century, the Narkomsen-expedition detected *Dermacentor nuttalli*, *Hyalomma dromedarii* and *Ixodes* sp. in Mongolia. In 1948 V.B. DUBININ determinated *Ixodes* sp. *as Ixodes crenulatus*. The 50ties and 60ties were the decades of the most intense research.

Mongolian and Russian experts detected, especially after the foundation of the Institute for Especially Dangerous Diseases in Ulaan Baatar in 1965, *Rhipicephalus pumilio* (EMELYANOVA 1953), *Hyalomma asiaticum* (EMELYANOVA 1957), *Ixodes lividus* (EMELYANOVA et al. 1963) and *Dermacentor asiaticus* (EMELYANOVA et KOZLOVSKAYA, 1967). FILIPPOVA (1984) synonymises *Dermacentor asiaticus* as a midget-form of *Dermacentor silvarum.* In 1966 HOOGSTRAAL describes *Haemaphysalis pospelovashtromae* formerly determined as *Haemaphysalis warburtoni* (EMELYANOVA, 1978) based on larvae and nymphs.

From the 70ties on, many publications have occured handling the taxonomy, distribution and medical importance of ticks in Mongolia. KUCERUK, IVANOVA & NEROVOV (1969) describe the estimated distribution of *Ixodes persulcatus* about 200 km southward than originally the distribution-border was meant to lie. KIEFER et al. (1980) confirmed the new distribution of this species in Mongolian tajga territory Khyalganat 105°12´ E, 49°24´ N on the hosts *Tetrastes bonasia* and *Cyanopica cyanus* at 14.07.1975. Similarily these authors detected *Ixodes laguri*

on *Meriones unguiculatus* 10 km southeast of Ulaanbaatar 106°54´ E, 47°57´ N in July 1974 (M. KIEFER et al. 1980, D. KIEFER et al. 2006). M. KIEFER et al. (1986) and D. KIEFER et al. (2007) detected *Ixodes berlesei* in Inget Tolgoi 103°36´ E, 49°15´ N on the host *Corvus dauricus* at the 14.07.1976. This was prooved N.D. EMELYANOVA. DASH (1986) published his dissertation "Ticks of Mongolia" (Humbolt Universität Berlin, Germany). DANCHILOVA (2006) created her dissertation "Ixodidae of the Bajkal-close-area and adjacent regions in Mongolia in correlation with vectors" and published also "Ixodidae of southern and eastern Sibiria and adjacent Mongolian areas" (DANCHINOVA et al. 2006). In addition she detected *Haemaphysalis concinna* in the floodplains of the Selenga river and *Argas vulgaris* in the Gobi desert.

3. Ixodidae and Argasidae found in Mongolia

Overview of existing species based on the listed literature, updated names of ticks after HORAK, CAMICAS & KEIRANS (2002), CAMICAS et al. (1998) and WALKER et al. (2000):

1. *Argas* (*Argas) vulgaris* Filippova, 1961
2. *Ixodes arboricola* (Schulze & Schlottke, 1930)f
3. *Ixodes berlesei* Birula, 1895
4. *Pholeoixodes crenulatus* (Koch, 1844)
5. *Ixodes laguri* Olenev, 1929
6. *Pholeoixodes lividus* (Koch, 1844)
7. *Ixodes persulcatus* Schulze, 1930
8. *Pholeoixodes prokopjevi* Emelyanova, 1979
9. *Haemaphysalis concinna* Koch, 1844
10. *Haemaphysalis demidovae* (Emelyanova, 1978)
11. *Haemaphysalis pospelovashtromae* Hoogstraal, 1966
12. *Dermacentor daghestanicus* Olenev, 1929 syn. *niveus* Neumann, 1897
13. *Dermacentor nuttalli* Olenev, 1928
14. *Dermacentor silvarum* Olenev, 1931
15. *Dermacentor asiaticus* Emelyanova et Kozlovskaya, 1967 = *Dermacentor silvarum* Filipova, 1984 ? - has to be confirmed on molecular level despite of synonymisation
16. *Hyalomma asiaticum asiaticum* Schulze et Schlottke, 1930
17. *Hyalomma asiaticum kozlovi* Olenev, 1931, inhabits China and south-western Mongolia
18. *Hyalomma dromedarii* Koch, 1844 - we can assume that it is a rare species in Mongolia and it has not been confirmed in Mongolia in present time.
19. *Rhipicephalus pumilio* Schulze, 1935

Based on the distribution of Ixodidae mentioned in the publications of YU XIN et al. (1997) and TENG KUOFAN & JIANG ZAIJIE (1991), FILIPPOVA (1977, 1997) and updated names of ticks after Horak et al. (2002) the following species can be expected in the southwest and probably east of Mongolia. *I. subterranus* can´t be expelled in northern Mongolia (DASH et al. 1988).

1. *Argas persicus* (Oken, 1818)
2. *Argas reflexus* (Fabricius, 1794)
3. *Carios vespertilionis* Latreille, 1796
4. *Alveonasus lahorensis* (Neumann, 1908)
5. *Alectorobius (T) tartarovskyi* (Olenev, 1931)
6. *Ixodes hyatti* Clifford, Hoogstraal et Kohls, 1971
7. *Ixodes redikorzevi* Olenev, 1927
8. *Pholeoixodes subterranus* Filippova, 1961
9. *Haemaphysalis danieli* Cerny et Hoogstraal, 1977
10. *Haemaphysalis punctata* Canestrini et Farzago 1878
11. *Haemaphysalis erinacei turanica* Pospelova-Shtrom, 1940
12. *Dermacentor marginatus* (Sulzer, 1776).
13. *Dermacentor pavlovskyi* Olenev, 1927
14. *Dermacentor reticulatus* (Fabricius, 1794)

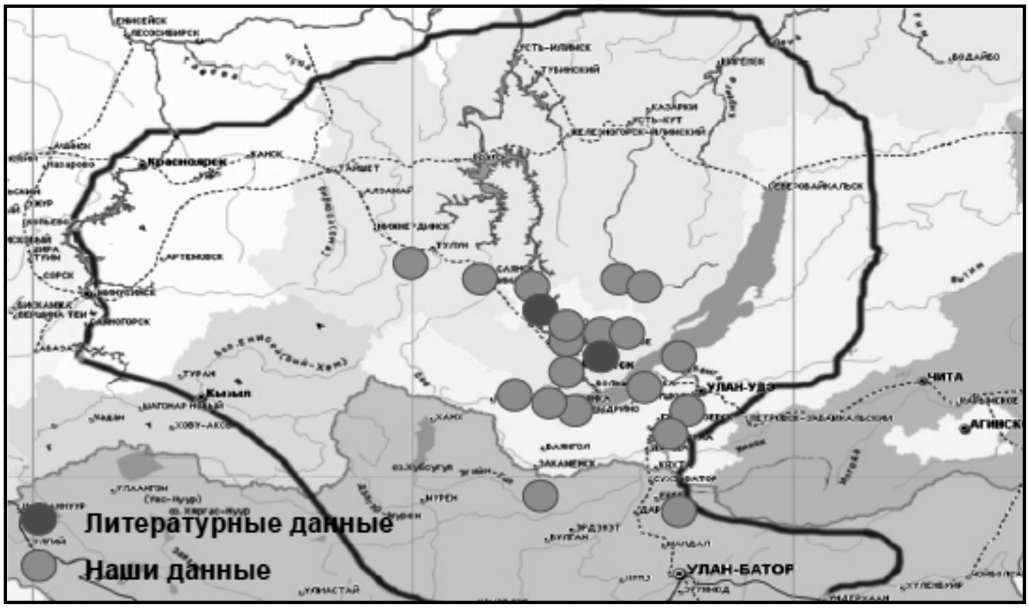

Fig.1: Distribution of *Heamaphysalis concinna* (brighter dots) after DANCHINOVA (2006), literature reference (darker dots).

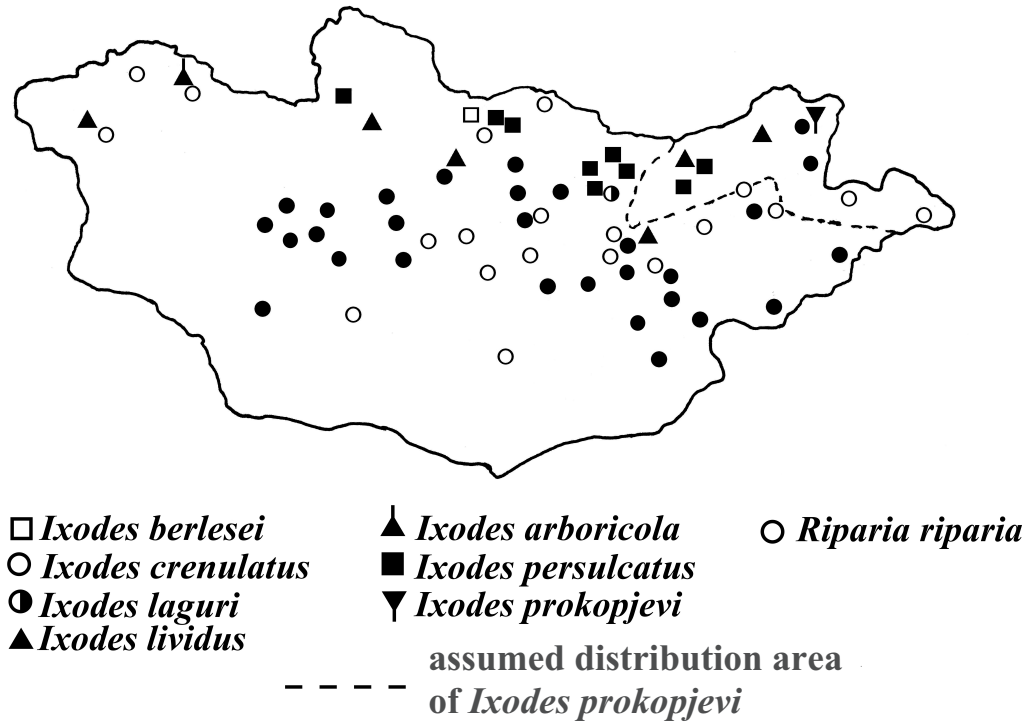

Fig. 2: Distribution of the genus *Ixodes* in Mongolia.

15. *Hyalomma detritum detritum* Schulze, 1919
16. *Hyalomma detritum scupense* Schulze, 1918
17. *Rhipicephalus turanicus* Pomerantsev, Matikashvili & Lototsky,1940
18. *Rhipicephalus schulzei* Olenev, 1929
19. *Rhipicephalus bursa* Canestrini et Fanzago, 1878
20. *Rhipicephalus sanguineus* (Latreille, 1806)
21. *Haemaphysalis verticalis* Itagaki, Noda et Yamaguchi 1944

4. Distribution

4.1. *China*

***Haemaphysalis verticalis* Itagaki, Noda et Yamaguchi 1944**

Global distribution: *Heilongjiang, Inner Mongolia, Jilin, Liaoning, Hebei, Shanxi, and Ningxia)*

Ixodidae are inhabitants of steppes and semi-deserts, principal hosts of all stages are rodents (ground squirrels, gerbils and others), but also are found on hedgehogs, dogs, cattle, and black-tailed gazelles (HOOGSTRAAL & KIM 1985, KOLONIN 2009, TENG & JIANG 1991).

In 2009 as a part of the Mongolian-Chinese research of natural foci (WANG LIN et al. 2009) approx. 111 specimens of *Haemaphysalis verticalis* were detected in the Xilin Gol Grassland, Inner Mongolia. The analysed locations of the project have a common phytocoenotic character, the Xilin Gol Grassland in Inner Mongolia is equivalent to the Ovorkhangai area and the presence of *Haemaphysalis verticalis* is highly probable in this area of Mongolia. In the literature-overview only resources are listed in which detailed data concerning discrete Ixodidae and Argasidae species are comprehended.

4.2. *Ixodidae in Mongolia and their distribution*

***Ixodes arboricola* Schulze et Schlottke, 1929**

Mongolia: Uvsnur Aimak; from nests of *Oenanthe isabellina* and *Montifringilla nivalis* (Fig. 2).

Global distribution: Northern and Central Europe (Norway, Sweden, Denmark, Holland, Great Britain (southern part), France, Switzerland, Germany, Austria, Poland, Latvia, Byelorussia, Ukraine, Czechia, Slovakia, Hungary, Romania, Bulgaria, Italy, Africa-Egyp, Asia, Israel, Caucasus - Georgia, Azerbaijan, Afghanistan, Mongolia, China (Xingjiang, Inner Mongolia, Tibet), Russia: Primorsk.

All stages parasitize bird nesting in hollows and burrows (starlings, jackdaws, tits, sparrows, owls and other birds). High abundance of ticks is reported in nests of the peregrine falcon *Falco peregrinus* located in grottos (KOLONIN 2009, DASH 1986, DASH et al.1988, 1989; KIEFER et al. 2006, 2007; SIUDA 1993).

***Ixodes berlesei* Birula, 1895**

Mongolia: Finding from 1976, proved by N.D. EMELYANOVA detected *Ixodes berlesei* in Inget Tolgoi (103°36 ´E, 49°15´ N) on the host *Corvus dauricus* at the 14.07.1976; D. KIEFER et al. (2006) . (Fig. 2).

Global distribution: Russia - Caucasus, Mountains of South Siberia, Bering Island, Kazakhstan, Kirghizia, Tajikistan, Turkmenistan, Nepal.

Species found on birds nestling in rocks: the falcons *Falco tinnunculus,* the swift *Apus pacificus,* Male unknown (DASH 1986, KOLONIN 2009, KIEFER et al. 2006, 2007).

***Pholeoixodes crenulatus* Koch, 1844**

Mongolia: Connected to its primery host, the marmot, it is distributed in a large area of Mongolia. It is known from: Central Aimak; Khangay, Taishir, Khentey, Gobi-Altay Aimak, Dzabkhan Aimak: between Mongol and Gobi Altay–mountains, Khan-khuhey - and eastern Mongolia (Fig. 5).

Global distribution: Europe from Ireland and Great Britain to the north up to Denmark, Germany, Poland, Byelorussia and to the south up to Spain, Italy, former Yugoslavia, Bulgaria, Ukraine; steppe and forest-steppe zones of Russia up to Altai Kray, South Siberia to Primorsk; Asia to the south up to Iran, Afghanistan, India (Kashmir), Mongolia, China (Xingjiang, Tibet, Inner Mongolia).

Primary hosts of all stages are rodents (especially marmots) and carnivores (Mustelidae, Canidae). This tick-species seems to be one of the main reservoirs of plague in Mongolia (BOLORMAA et al. 2008, DASH 1986, DASH et al. 1988, 1989; KIEFER et al. 2006, 2008; SIUDA 1993).

***Ixodes laguri* Olenev, 1929**

Mongolia: Kiefer et al. (1980) detected *Ixodes laguri* on *Meriones unguiculatus* 10 km southeast of Ulaanbaatar (106°54´ E, 47°57´ N) in July 1974; D. KIEFER et al. (2006) north west Ulaanbaatar - *Meriones unquiculatus* (Fig. 2).

Global distribution: Slovakia, Hungary, Romania, Bulgaria, Turkey, Moldova, Ukraine; Russia (Rostov, Volgograd and Astrakhan Oblasts, Kalmykia, Northern Caucasus); Georgia, Armenia, Azerbaijan, Kazakhstan, Turkmenistan.

Distributed on plains and mountain-steppes, primary hosts of all stages are ground squirrels of the genus Spermophilus. This species is a vector of Tularemia (DASH 1986, DASH et al. 1988, 1989; KIEFER et al.1980, 2006, 2007; SIUDA 1993).

***Pholeoixodes lividus* Koch, 1844**

Mongolia: Shavart-nuur, Khentei aimak, Khubsugul Aimak, Delger Muren, Bulgan Aimak, Selenga river. All found in nests of *Riparia riparia* (Fig. 2, 7).

Global distribution: Ireland, Great Britain, Norway, Sweden, Finland, Holland, France, Switzerland, Slovakia, Poland, Austria, Germany, Romania, Bulgaria, Greece, Ukraine, Latvia, Lithuania, Estonia, Byelorussia, Russia, Japan.

The ticks inhabit nests of the bank swallow *Riparia riparia.* They parasitize the sparrow *Passer montanus*, occupying deserted nests of swallows. Unfed larvae winter life cycle lasts one year (DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 1980, 2006, 2007; SIUDA 1993).

***Ixodes persulcatus* Schulze, 1930**

Mongolia: KUCERUK, IVANOVA & NEROVOV (1969) describe the estimated distribution of *Ixodes persulcatus* about 200 km southernly than originally the distribution-border was meant to be. KIEFER et al.(1980) confirmed the new distribution area of this species in Mongolian tajga territory, Khyalganat (105°12´ E, 49°24´ N) on the hosts T*etrastes bonasia* and *Cyanopica cyanus* on 14.07.1975 in Bulgan Aimak, Selenge somon, Seleng Aimak, Kjalganat, Dzunkhare and Khentei Aimak (Batsumber somon) (Fig. 3).

Global distribution: Finland, Poland, Russia, China (Xingjiang, Tibet, Shanxi, Ji-lin, Liaoning, Heilongjiang), North Korea, Japan (Hokkaido, Honshu), also reported in Taiwan.

Adults parasitize all accessible large and middle-sized mammals; immatures also infest all accessible small and middle-sized mammals and birds. Life cycle takes 2-5 years, depending on the region. Adults are active during spring and summer; immatures are active during the whole warm period. This species is very aggressive and a vector of Tick-borne encephalitis, Tularemia, Lyme and others diseases (BOLORMAA et al. 2007, BAYARDALAL & SARANTSETSEG 2004, DASH et al.1988, KIEFER et al. 1980, 2006, 2008; KOLONIN 2009, SIUDA 1993).

***Pholeoixodes prokopyevi* Emelyanova, 1979**

Distributed on south-eastern Transbaicalia and north-eastern Mongolia.

It is a parasite of the Daurskian hedgehog *Mesechinus dauricus*. Females registered from May till September. Abundance-peak is in May. The ecology might be similar to *Ixodes hexagonus*,

according to the available data *Mesechinus dauricus* is the host for all reproductional states (EMELYANOVA 1979, KIEFER et al. 2006, 2007) (Fig. 2).

***Haemaphysalis concinna* Koch, 1844**

Mongolia: Selenga river (Fig. 1).

Global Distribution: Spain, France, Germany, Poland, Czechia, Slovakia, former Yugoslavia, Bulgaria, Romania, Hungary, Byelorussia, Ukraine (Crimea); Russia (North Caucasus, Rostov-Oblast); Asia: Turkey, Iran, Georgia, Kazakhstan, Kirghizia, China (Xingjian, Inner Mongolia), Peninsula of Korea, Japan.

The range is patched, a relict species. The species is hygrophilous, inhabits valleys and floodplains of rivers, waterlogged localities and the like. Mostly sporadic in its range, not numerous species, in the Far East of Russia *H. concinna* has continuous range and is quite abundant. It is a vector of Tick-borne encephalitis, Tularemia and Tick-borne Rickettsiosis (DANCHILOVA 2006, KIEFER et al. 2006, 2007; KOLONIN 2009, SIUDA 1993).

***Haemaphysalis demidovae* Emelyanova, 1978**

Mongolia: Bajankhongor Aimak - South Khangai-Khure Maral, Mandal, Zag somon (Emelyanova 1978) (Fig. 4).

Species described from nymphs and larvae collected on pikas, ground squirrels and voles. Females and males are unknown (BOLORMAA 2007, DASH 1986, DASH et al. 1988, 1989; EMELYANOVA 1978, KIEFER et al. 2006, 2007).

***Haemaphysalis pospelovashtromae* Hoogstraal, 1966**

Mongolia: In 1966 HOOGSTRAAL described *Haemaphysalis pospelovashtromae*, formerly determined as *Haemaphysalis warburtoni* (JEMELYNOVA 1978) based on larvae and nymphs. It inhabits shrub-steppes in Mongolia, Arkhangai Aimak -Tarba gatay, Khangay -Tsakhir, Tariat and Zhargalant somon; Gobi Altay Aimak, Beger,Tsogt, Khaliun, Tonkhil somon, Taishir-Narin somon, Khar azgara, Burkhan buulay Tamch, Khasagt Khairkhan, Darvin, south part of Mongol Altay; Bajankhongor Aimak - South Khangaj, Khure, Maral, Mandal, Dzingolant and Dzak somon; Gurvan Sajkhan; West Mongolia: Bajan Ulgij Aimag; Bukhey ula, Khovd Aimak; Uvsnur aimak and Jelyn-am (Gurvan Sajkhan), South-Gobi Aimak (Fig. 4).

Global distribution: Armenia, Azerbaijan, Georgia, Russia (Daghestan, Altai), Kazakhstan, Kirghizia, Uzbekistan, Tajikistan, Iran (Mazendaran), Pakistan (north-eastern), China (Xingjiang)**.**

Primary hosts of adults are wild and domestic sheeps and goats, hosts of immatures are rodents, pikas, hares and birds. Adults are active in spring, immatures infest animals from spring to autumn (BOLORMAA 2007, DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007).

***Dermacentor asiaticus* Emelyanova, Kozlovskaya, 1967**

Mongolia: DASH (1969) mentions it from the area around Under Khan, from the Onon-River valley and its left feeder river Balz. In our collection it is registered in nine locations from the aimaks: Bajan Ulgij Aimak, Tolbonur, Sagsaj somon; Khovd Aimak, Khovd somon, Uench gol; Uvsnur Aimak, Achit nur; Dzavkhan Aimak, Sant Margaz, Telmen somon; Khubsugul Aimak, Erdene Bulgan; and Slelenge Aimak, Darkhan somon. These data are shifting the distribution of this species several hundred kilometers to the West (Fig. 6).

Known from the surrounding area of Khabarovska, delta of the Selenga-river, the river Krepostnoj (Primorsky Kray) (EMELYANOVA & KOZLOVSKAYA 1967).

Dermacentor asiaticus (JEMELYANOVA & KOZLOVSKAYA 1967) FILIPOVA (1984) synony-mises *Dermacentor asiaticus* as a midget-form of *Dermacentor silvarum.* In any case we need a molecular and morphological determination (DASH 1986, DASH et al. 1988, 1989; KIEFER et al. 2006, 2007).

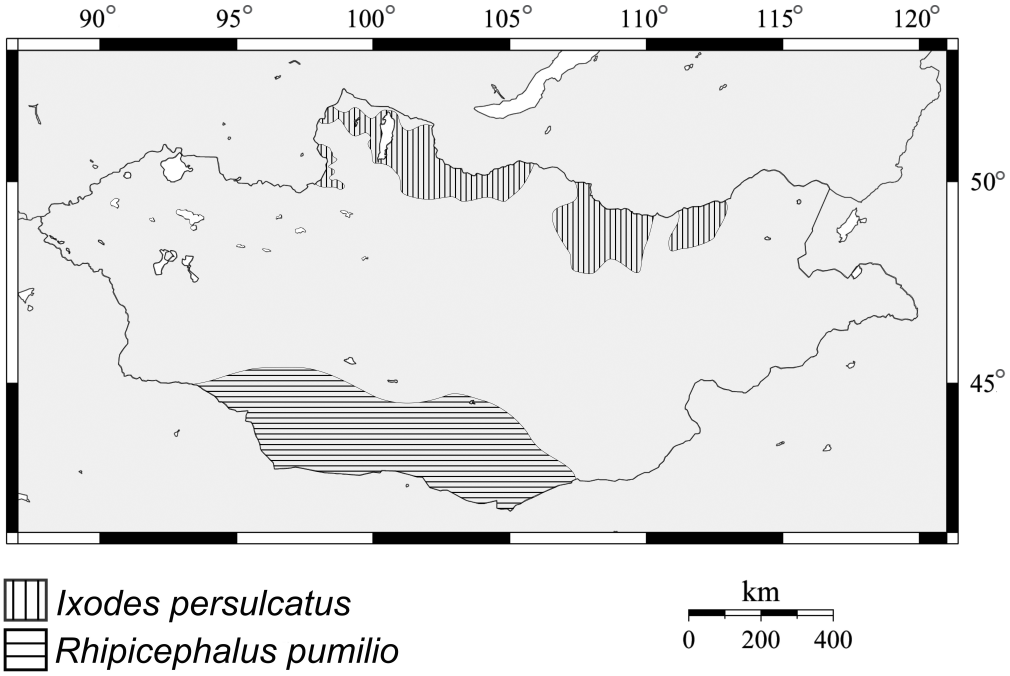

Fig. 3: Distribution of *Ixodes persulcatus* and *Rhipicephalus pumilio* in Mongolia.

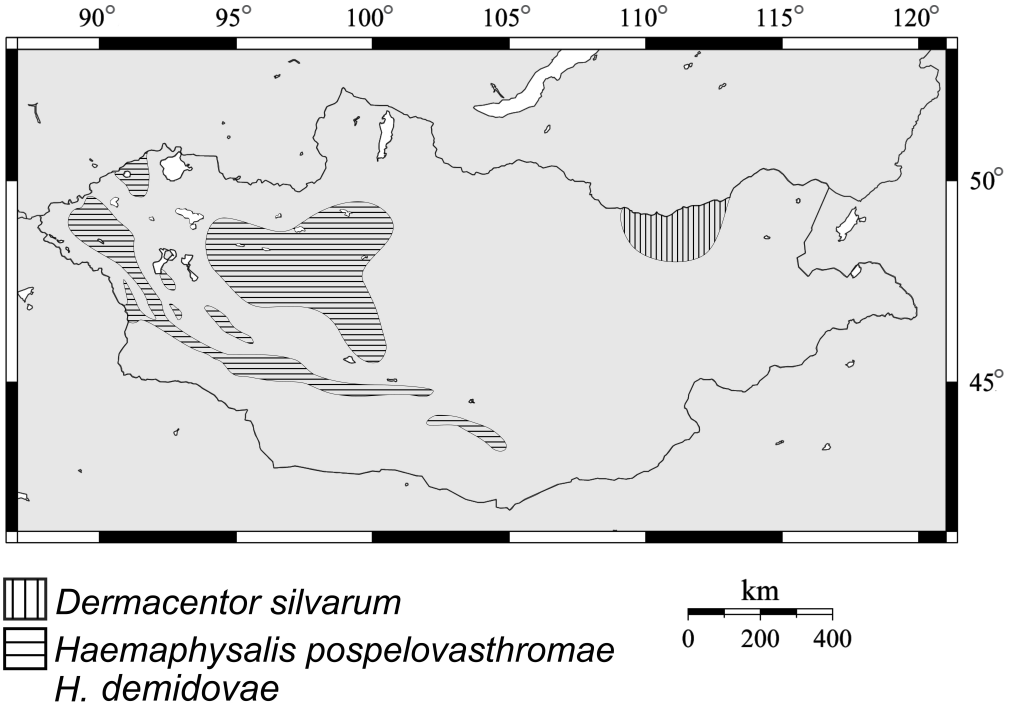

Fig. 4: Distribution of *Dermacentor silvarum* and *Haemaphysalis pospelovasthromae* in Mongolia.

***Dermacentor daghestanicus* Olenev, 1929**

Mongolia: West Mongolia: Khovd Aimak, Bujant somon, Ereg somon, Majandag somon, Dariv somon; Gobi altay Aimak, Beger somon, Naran somon; South-Gobi Aimak, Sevrej somon, Khurmen somon; East-gobi Aimak; Erdene somon, Sulanchere somon; Bajnkhongor Aimak; Khangai, Taishir, East Mongolia (Fig.6).

Global Distribution: Species certainly occurs in Russia (Daghestan, Chechen Republic, Stavropol Kray, Kalmykia, Astrakhan Oblast), Kazakhstan, Uzbekistan, Tajikistan, Turkmenistan, north-eastern Iran, also found on Sicily (Italy). Apparently it is also present in China (Inner Mongolia, Gansu, Xingjiang).

After KOLONIN (2009) this species occurs mainly in desert and semi-desert regions where it inhabits floodplains, oases, reeds, etc. Along river valleys it is ascending up into mountain-areas. It is common and abundant in flood-plains of Middle-Asian rivers. Principal hosts of imagines are live-stock, immatures feed on small mammals. Life cycle takes one year. Adults are active in spring; second small increase of activity is registered in autumn. Immatures parasitize the hosts in summer (KOLONIN 2009). It is a vector of Tularemia, Q-fever, Crimea-Congo hemorrhagic fever and Piroplasmoses (BOLORMAA 2008, DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007).

***Dermacentor nuttalli* Olenev, 1929**

Mongolia: Inhabitant of forest-steppe, lowlands and mountain-steppe as well as semi-desserts, it is the most abundant tick of Mongolia occurring almost in the whole country except of deserts in the South and the highest mountains. DASH (1986) mentioned that from one cow more than 3000 ticks were collected.

Global distribution: Russia (Altai, Kemerovo, Khakasia, Tuva, southern Krasnoyarsk Kray, the south of Irkutsk Area, Buryatia, Chita Oblast), Kazakhstan (Zaysan Depression), China (Xingjiang, Inner Mongolia).

Primary hosts for adults are livestock; immatures feed on rodents, hares and pikas. Adults are active in spring and less active in autumn. Some males and females spend the winter on the hosts. Immatures feed on the hosts in summer, life cycle takes one year. It is a vector of Tick-borne Rickettsiosis of North Asia and Tularemia as well (BOLORMAA 2007, DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007). TSERENNOROV et al. (2008) selected plague strains from *D. nuttalli*, which were collected from marmots; pikes in some provinces in 1970-2007.

***Dermacentor silvarum* Olenev, 1931**

Mongolia: Forests and forest-steppes, Khentey aimag (Fig. 4).

Global distribution: Russia from Omsk area through Novosibirsk and Kemerovo area, Altai and Krasnoyarsk Kray, Tuva, Khakasia, Irkutsk area, Buryatia, Chita and Amur area to Khabarovsk and Primorsky Kray; Kazakhstan (Zaysan Depression, foothills of Saur, southern Tarbagatai), China (Xingjiang, a Gansu, Inner Mongolia), North Korea. There are findings in Yakutia, southern Sakhalin.

In the Far East ticks penetrate into the heart of the taiga along light biotopes (glades, fire-sites and the like). The highest abundance is registered in dry bushes and glades in forests. It avoids moist biotopes. Primary hosts of adults are wild and domestic large and middle-sized mammals, ticks also occur on hares and hedgehogs. Immatures feed on rodents, hares, hedgehogs. Life cycle takes one year. It is a vector of Tick-borne encephalitis, North Asia tick-borne Rickettsiosis and Tularemia (BOLORMAA et al. 2007, DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007).

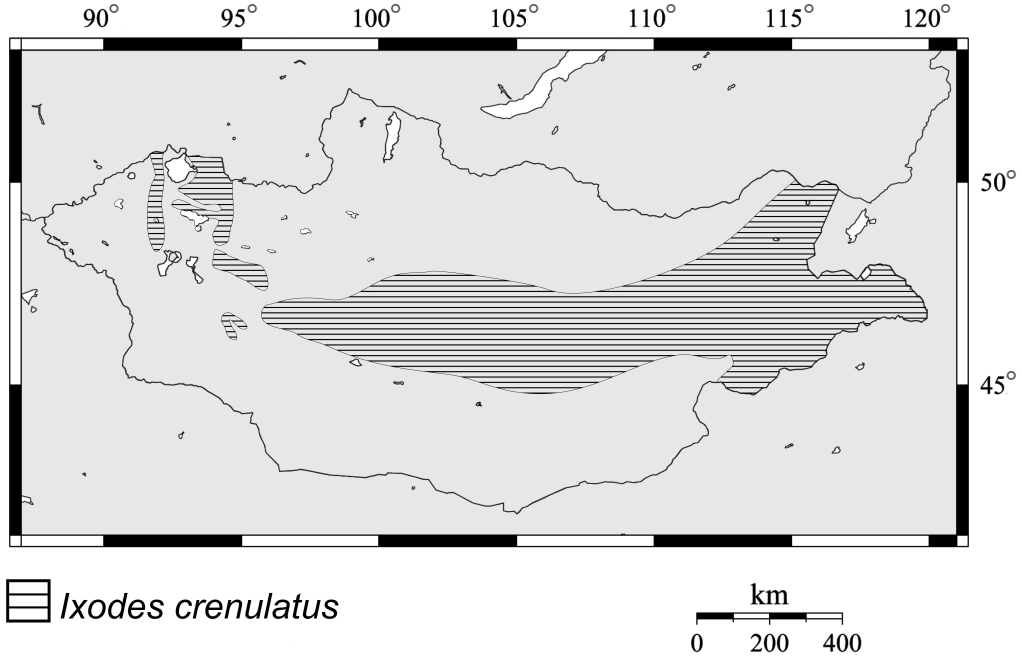

Fig. 5: Distribution of *Ixodes crenulatus* in Mongolia.

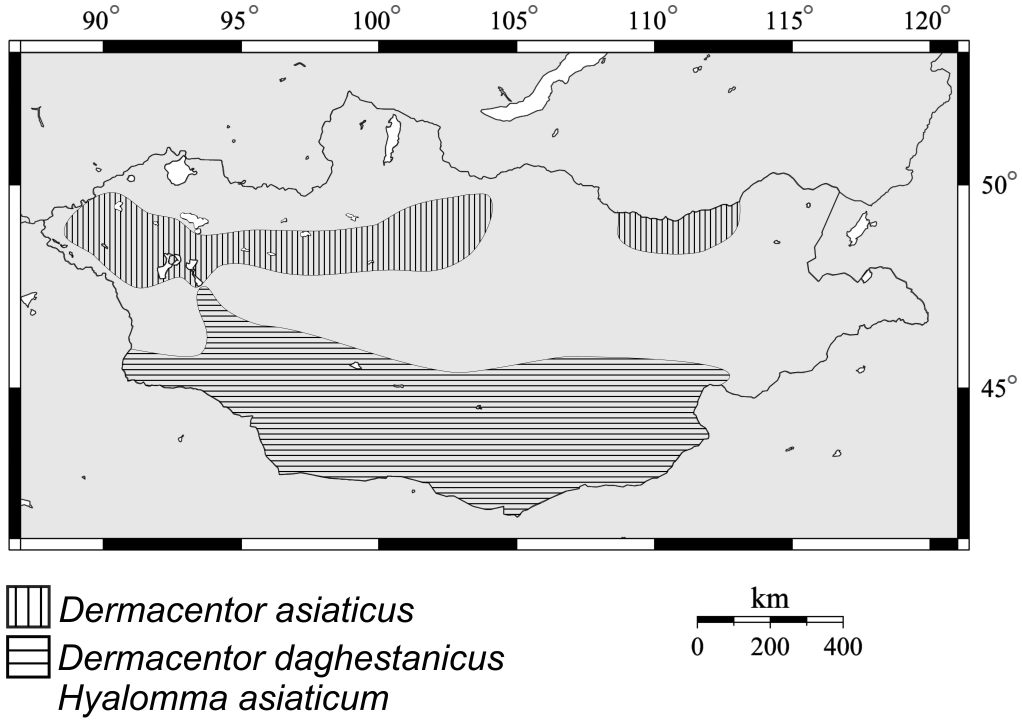

Fig. 6: Distribution of *Dermacentor asiaticus, D.daghestanicus and Hyalomma asiaticum*.

***Hyalomma asiaticum* Schulze et Schlottke, 1929**

Mongolia: Cisaltaj, Gobi-Tzonzhi, Gurvan bekhtij, Bajandalaj somon, South-Gobi Aimak; Khovd Aimak, Mongolian Altay; Bajankhongor Aimak; East-Gobi Ajmak. Northern distribution 48°10´, Khobdo somon; Eastern distribution 112 °, Erdene somon, East-Gobi Aimak (Fig. 6).

Global distribution: Turkey, Syria (northern), Iraq (northern), Armenia, Azerbaijan, Russia (Daghestan, Astrakhan Oblast), Iran, Afghanistan, Pakistan, Kazakhstan, Kirghizia.

Primary host of imagines is livestock. Immatures parasitize small mammals. This species is a vector of Crimean-Congo Haemorrhagic Fever.

According to KOLONIN (2009) species is divided into three subspecies: *H. asiaticum caucasicum* Pomerantzev (1939), occuring in western parts of the range to the east up to the Caspian Sea and Iran; *H. asiaticum asiaticum* SCHULZE ET SCHLOTTKE, 1929 spreads further to the east up to China and Mongolia; *H. asiaticum kozlovi* OLENEV, 1931 inhabits China and south-western Mongolia. *H. a. asiaticum* and *H. a. caucasicum* interbreed and produce fertile offspring easily. According to HOOGSTRAAL & VALDEZ (1980) in Iran, where the ranges of these subspecies overlap, subspecies identification is problematic. All subspecies differ slightly ecologically (APANASKEVICH 2002, BOLORMAA et al. 2007, DASH 1986, DASH et al. 1988, 1989; HOOGSTRAAL & VALDEZ 1980, KOLONIN 2009, KIEFER et al. 2006, 2007).

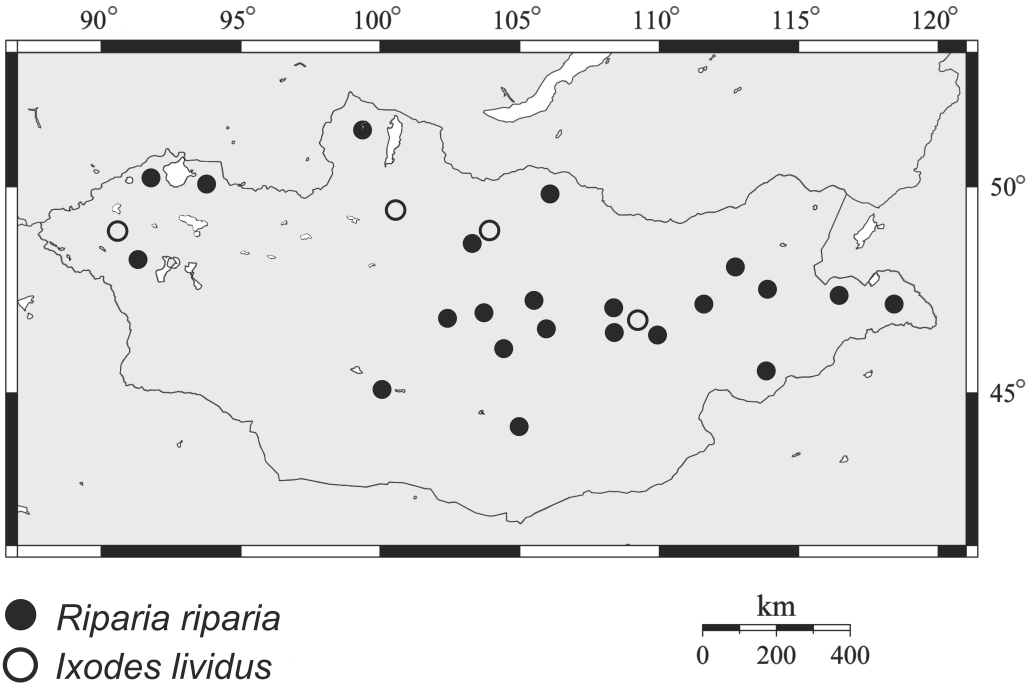

Fig. 7: Distribution of *Riparia riparia* and *Ixodes lividus* in Mongolia.

***Hyalomma dromedarii* Koch, 1844**

Mongolia: First time registered by OLENEV (1931) and SVIRSKA (1941) in sout-western Mongolia; DASH (1986) mentions this species from Cisaltay Gobi Gurvan Bechiy, Bajandalaj somon, South-Gobi Aimak. Molecular and morphological analyses have to be made in order to verify this species. We can assume that it is a rare species in Mongolia and it has not been confirmed in Mongolia yet.

Global distribution: According to KOLONIN (2009) North Africa to the south up to Senegal, Mali, Chad, Sudan, Kenya; Canary Islands; Asia: Turkey (eastern), Israel, Syria, Iraq, Saudi Arabia, Yemen, Oman, Armenia, Azerbaijan, Iran, Afghanistan, Pakistan, Kirghizia (Fergana Valley), Uzbekistan, Turkmenistan, Tajikistan, China (Xingjiang), India.

Adults parasitize livestock, preferring camels. Life cycle can occur on one, two and three hosts. Immatures feed on small or large mammals, according to life-cycle. It is a vector of Crimean-Congo Haemorrhagic Fever, Theileriosis and other diseases of livestock (BOLORMAA et al. 2007, DASH 1986, DASH et al. 1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007).

***Rhipicephalus pumilio* Schulze, 1935**

Mongolia: First time registered by EMELYANOVA (1953). Western Mongolia 93°20',southern part of Mongol Altay-Bajan Undur somon ,Khairkhan somon , Cisaltay gobi, Bajankhongor Aimak-South Khangay, Taishir in the eastern part of Mongolia South-Gobi Aimak 106°20' and North Shargin Gobi 46° (Fig. 3).

Global Distribution: Russia from Stavropol Kray across northern Chechen Republic and Daghestan, Kazakhstan, Kirghizia, Uzbekistan, Tajikistan, Turkmenistan, China (Xingjiang, Inner Mongolia).

Adults parasitize various mammals, preferring the Tolai hare *Lepus tolai* and hedgehogs. Immatures feed on hares, hedgehogs, rodents and birds. All stages are active during the whole warm season; adults have one peak of activity in April-June, while larvae and nymphs have two peaks: in April-May and July-August. It is a vector of Astrakhan fever, caused by *Rickettsia conorii,* Crimean-Congo Hemorrhagic Fever, Tularemia and Plague (EMELYANOVA 1953, DASH 1986, DASH et al.1988, 1989; KOLONIN 2009, KIEFER et al. 2006, 2007).

Based on the distribution and ecological requirements of Ixodidae mentioned in the publications of YU XIN et al. (1997),TENG KUOFAN & JIANG ZAIJIE (1991), FILIPPOVA (1977, 1997) and WALKER et al. (2000), the occurence of further 22 Ixodidae species can be estimated in the northern, southwestern and eastern parts of Mongolia.

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