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Review of investigation of ectoparasites in natural plague foci of Mongolia and their epizootological value

Key words**:** Fleas, lies, ticks, epizootology, plague, Mongolia, *Yersinia pestis*

Introduction

Demberel (1996) counted that plague natural foci distributed in Mongolia and developed a classification on spatial structure of plague natural foci, divided them into 3 typhical (mountain steppe, steppe and gobi or desert like steppe), 12 regional, 52 meso and 170 micro foci.
Yersinia pestis pestis and *Y. pestis altaica*, *Y. pestis ulgeica* are the subspecies which circulated in natural plague foci in Mongolia.
The fleas, ticks and lies are vector in natural plague foci of Mongolia. Many investigations have epizootological value for species composition, distribution ecology, dynamic and potential of transmitted infection. Study for main vectors are very significant to prevent and control, known the situation of natural foci.
The main purpose of this study is to analyze and monitoring on plague of ectoparasites investigation on natural foci in Mongolia.

Materials and Methods

We reviewed publication materials on plague epizoology and study reports, species composition, distribution, number dynamics, ecology condition, natural foci in Mongolia.

We used mainly GIS software titled on Arcview 3.2 and other programs.

Results and Discussion

Distribution of ectoparasites and species composition

At natural plague foci of Mongolia registered 158 species fleas included 37 genus, 7 family; 9 species lies depending on 5 genus, 5 family and 15 species Ixodes ticks of 5 genus, 8 species trombicul ticks of 3 genus, 20 species gamasus ticks of 10 genus (Figure 1).

Dominating ectoparasites at natural plague foci by classification:

Fleas (*Siphonaptera*): *Leptopsyllida*e (8 genus, 56 species), *Ceratophyllidae* (10 genus, 39 species), *Ctenophthalmidae* (8 genus, 38 species),

Lies (Anoplura): *Hoplopleuridae* – 1 genus, 3 species, *Neohaematopinidae* – 1 genus, 2 species,

Ticks (*Acarina, Parasitiformes*): *Ixodidae* – 5 genus, 15 species, *Haemagamasidae* – 1 genus, 4 species, *Laelaptidae* 3 genus, 7 species (Bolormaa 2005).

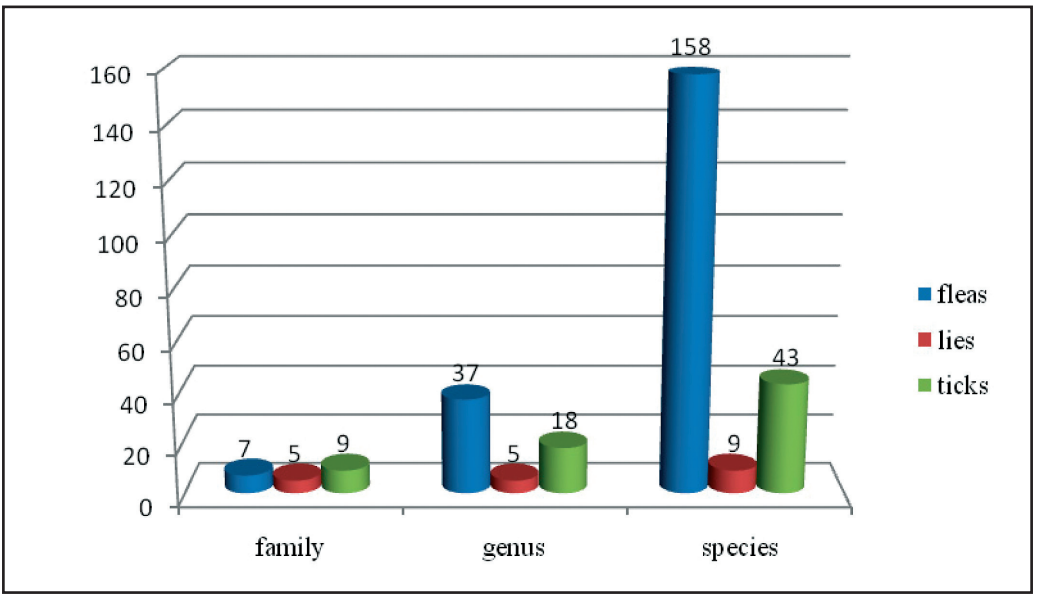

Fig. 1 Ectoparasites distributed at natural plague foci of Mongolia

Kiefer et al. (2006) registered 160 (180) subspecies, species fleas at Mongolia and classified 16 sections by distribution.

Review of ectoparasites

First checklist of Mongolian Siphonaptera was published by Kiefer et al. 1984.
Koshkin & Khumarkhan (1973) and Batjil (1990) have investigated the correlation of gender of fur fleas of *Marmota sibirica* and *Ochotona dahurica* at Mongol Altai mountain. After that Bolormaa (1999) studied sex ratio of hair and wool fleas at the plague foci of Khuvsgul region. The research results have shown that female number dominated there.
Kiefer (1993) published the monography of fleas of Mongolia by investigation of sections of ecology-geopgraphy. The first investigations for flea populations ecology were "Epizootological value of *Citellophilus tesquorum sungaris* (Jordan 1929), *Frontopsylla luculenta luculenta* (Jordan & Rothschild 1923), fleas at natural plague foci of Mongolia" by Tserennorov (1999). This monography has had the result that growth of fleas changed 1 times at year and inactivate on March-September related with life particularities of hosts.
Kiefer (2009) and others have investigated distribution of 17 ticks, maps that covering *Ixodidae* genus of Mongolia. For ecological investigation established that active time of adult ticks was on spring, summer or May – June depending on season and climate.

Dynamics and density of ectoparasites

Bolormaa (2005) noted that the fleas density on hosts was maximum (119.0 – 125.7) in Mongol Altai, Khangai mountain steppe zone; average (64.4 – 114.3) at Khangai, Khentii mountain forest steppe, steppe zone on central regions and minimum (32.0 – 40.4) at eastern steppe, desert or desert steppe of south regions. Fleas density directly ($r = 0.3 – 0.7$) correlated activity of natural foci and human mortality of plague. Especially, high ($r = 0.6 – 0.7$) correlated of fleas density of main host *Marmota sibirica* and that is shown possible to influencing on activity of foci and human mortality.
For density investigation of ticks was maximum of April – June and May – June at natural plague foci.

Epizootological value of ectoparasites

Munkhtumur et al. (1999) noted that detected plague cultures from 34 subspecies, species fleas at natural plague foci of Mongolia. Registered 5 species of 2 genus were very active vectors, 6–7 species of 5 genus was active vectors and 8 species of 7 genus fleas was low active vectors, 9 species of 8 genus don't transmitted the plague agents.

Investigated of potential for transmitted infection of 2 species fleas of *Citellus undulatus* at laboratory of institution of plague investigation at Stavropol of Russia. For experimental investigation established the *Citellophilus tesquorum sungaris* fleas was low active, *Frontopsylla luculenta luculenta* fleas inactive participated for transmitted plague agents (Tserennorov 1999). Bolormaa (2005) registered 80.05% of fleas in *Ceratophyllidae* family for all isolated plague cultures on natural plague foci between 1960-2005 (Figure 2).

Last 50 years detected 24 plague cultures from ticks of hunted animals, their holes, burrows from Gobi-Altai, Bayan-Ulgii, Arkhangai, Khentii, Khuvsgul, Zavkhan, Dornogobi and Umnugobi provinces.

Tserennorov (1990) noted that detected 5.8% from lies of all plague cultures which isolated from ectoparasites between 1980-1990 and 6.1 % between 1990–2005 detected from lies *N. p. tarbagani* Dubinin (Tserennorov 1990, Bolormaa 2005).

Subspecies of plague cultures which detected on 2000–2007 at natural plague foci of Mongolia (Ganbold et al. 2009):

Yersinia pestis altaica subspecies agents from ectoparasites 43,7 %,

Yersinia pestis ulgeica subspecies agents 5.5 %,

Yersinia pestis pestis subspecies agents 24.7 %.

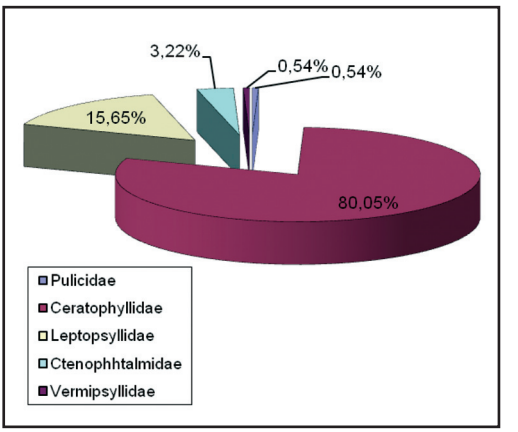

Fig. 2 Plague cultures detected from fleas

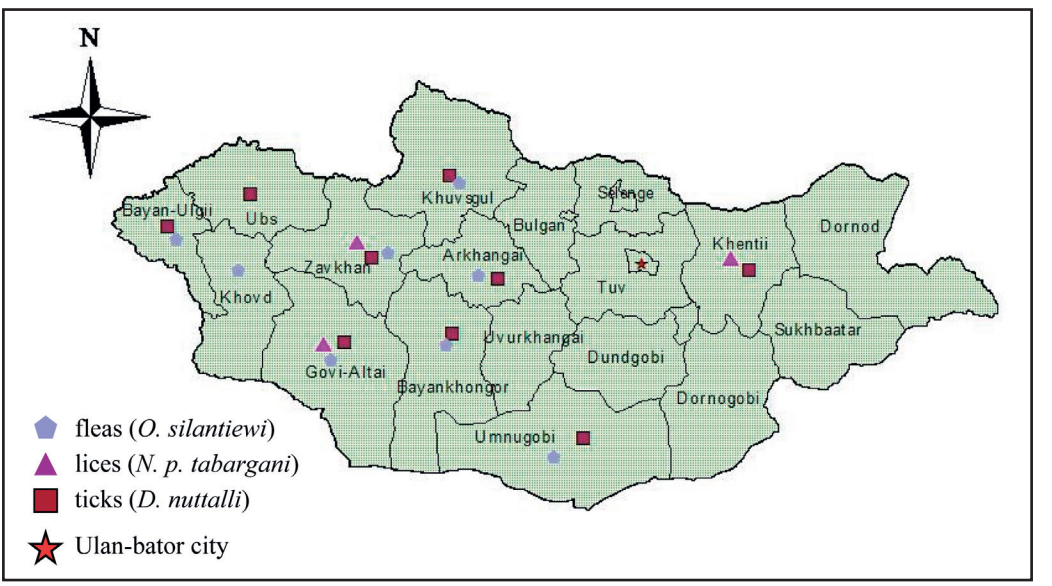

Fig. 3 Ectoparasites of plague cultures from the provinces of Mongolia

Conclusion

- Totally, 158 species fleas of 37genus of 7 families, 9 species lies of 5 genus of 5 families and 15 species Ixodidae ticks of 5 genus, 20 species gamasus ticks of 10 genus, 8 species trombicul ticks of 3 genus were distributed in Mongolia.
- The maximum number and density of fleas recorded in Mongol Altai, Khangai mountain steppe zone, moderately number in Khangai, Khentii mountain forest steppe, steppe zone of central regions, minimum number recorded in eastern steppe, desert, and desert steppe of south region.
- *Yersinia pestis pestis*, *Y. pestis altaica* and *Y. pestis ulgeica* subspecies were circulated in natural plague foci in Mongolia.

Zusammenfassung

Review zur Untersuchung von Ektoparasiten in natürlichen Pestherden der Mongolei und ihr epizootologischer Wert

Aus der Mongolei sind 158 Floharten aus 37 Gattungen und 7 Familien, 9 Lausarten in 5 Gattungen und 5 Familien sowie 20 Gamasidenarten mit 5 Gattungen und 8 Trombiculidenarten aus 3 Gattungen bekannt.

Die größten Populationsdichten von Flöhen wurden im Mongolischen Altai und in der Gebirgssteppe des Changaj ermittelt, mittlere Dichten im Changaj, der Waldsteppe des Chentej sowie den Steppen der Zentralmongolei. Geringere Dichten fand man in den östlichen Steppen sowie in der Halbwüsten- und Wüstenzone.

Der Pesterreger *Yersinia pestis* kommt in den Pestherden der Mongolei einschließlich der Nominatform in 3 Unterarten vor.

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