



Original article

The Chilopoda (Myriapoda) of the Khentey-Mountain Range, Northern Mongolia. Communities of different forest-types under a varying fire regime



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ABSTRACT

The Khentey-Mountain Range, a “hotspot” of biodiversity in Mongolia, stretches from the Mongolian capital Ulaanbaatar in north-eastern direction towards the Russian border and beyond. A variety of forest types (Light Taiga, Dark Taiga, Mixed Taiga) covers the slopes and intermixes with steppe areas. Wild fires are frequent and a part of ecosystem dynamics. The Chilopoda are one of the most important groups of carnivorous soil arthropods, but little is known about their diversity in Mongolia and response to fires. We sampled chilopods in 94 plots in different forest types with varying fire regime, in three locations in the West, South and East Khentey. Each plot included five pitfall traps and a hand sampling of soil and litter. We recorded ten species of Chilopoda in the Khentey-Mountain region, eight Lithobiomorpha and two Geophilomorpha. *Lithobius giganteus* Sseliwanoff, 1881 and *Lithobius alticus* (Loksa, 1965) were by far the most widespread centipede species. Species richness of Chilopoda communities was higher in the West than in the South and East, which was presumably caused by higher precipitation and the resulting higher diversity of the forests. Within the Western Khentey species richness of Chilopoda and tree species increased simultaneously. Generally, we found the highest diversity of Chilopoda at higher altitudes, which corresponds with the increasing precipitation, and –exclusively for the Lithobiomorpha – with locations in floodplain forests. Altogether there was little influence of fire on the diversity and individual density of Chilopoda, although freshly burnt areas provided a short term attraction to certain species.

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1. Introduction

The present study was conducted in different types of forest and forest-steppe around the Khentey Mountain Range in northern Mongolia. The Khentey Mountains are a “hotspot” of Mongolian Biodiversity. There, the Siberian Taiga meets the central Asian Daurian Steppe region, and forms a special habitat, the forest-steppe. In addition, within Khentey Mountain area, the central Siberian Dark Taiga borders to the eastern Light Taiga [1]. Due to the central-Asian location, flora and fauna of Khentey Mountains

feature both, eastern and western Palearctic elements.

Chilopoda are all predators and their occurrence is closely related to the humidity of the habitat [2]. So far, they have been sparsely investigated in Mongolia. We are aware of six papers on chilopods collected within Mongolia: Sseliwanoff [3], Dobroruka [4,5], Loksa [6,7] and Ulykpan [8]. None of these works deals with the ecology of chilopods.

We investigated the influence of different forest types on the distribution of soil invertebrate species within this specific region. Beside the natural parameters of our sampling sites like altitude, tree-species diversity and stand density, we also regarded the fire regime, a factor much influenced by human activities. Despite its general nature as a normal periodic disturbance-factor within boreal forests [9], in Mongolia fire-regime has rapidly increased over the last decades due to anthropogenic influence and affects about 14% of the forest each year [10], resulting in a shift of forest

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cover from Dark to Light Taiga [11]. Forest recovery after fire may take more than 13 years in boreal Siberia [12], while for Mongolia 200 years are estimated [10].

In order to investigate the influence of forest-fires on the occurrence, distribution and diversity of chilopods we sampled ground arthropods in unburnt and recently burnt forest-stands of different forest types in the western and eastern part of Khentey Mountains. We expected high chilopod density in the freshly burnt plots and a weaker influence of fire with increasing time after the fire-event.

Due to the dependency of chilopods on humidity, we expected increasing chilopod abundance from the drier eastern, to the more humid western part of the Khentey Mountain range, as well from Light to Dark Taiga stands. Regarding the changes of evaporation, albedo, shading and soil thickness after a fire event, changes in the water supply of the habitat and consequently in the communities of humidity-dependent soil arthropods like Chilopoda were expected. Additionally fire leads to a short time increase of soil moisture in many Siberian soils due to a release of liquid water during melting of permafrost [13] and favours the development of the herb layer with the associated arthropods as chilopod prey. Both factors should promote a higher diversity and abundance of chilopods.

2. Material and methods

2.1. The study area

The Khentey-Mountain Range is a part of the central Asian watershed and stretches from the Mongolian capital Ulaanbaatar in north-eastern direction (Fig. 1). It is largely covered with coniferous forests, most of them *Larix* dominated “Light Taiga” that is replaced at higher altitudes by “Dark Taiga” consisting of shade-tolerant tree

species like *Pinus sibirica* and *Picea obovata* [11]. South-facing mountain slopes are mostly bare of forest and characterised by steppe-like vegetation. Precipitation increases from south to north and from the edges of the Mountain ridge towards its centre (Fig. 2). In the eastern part of the Khentey Mountains tree line and the occurrence of permafrost start at a higher altitude than in the west [11].

Wildfires are a periodic disturbance factor in the forests of Khentey Mountains. As a result Mongolian forests comprise a significantly higher amount of deadwood compared to boreal forests with a lesser fire regime [11]. Hessler et al. [14] report a median fire return interval of nearly 13 years from *Larix sibirica* stands in the central Khentey Mountains, based on tree ring studies from 1831 to 2007. According to Oyunsanaa [15], the mean fire return interval in the western Khentey Mountains (Khonin Nuga) is 8–12 years for Light Taiga stands and 39–46 years for Mixed and Dark Taiga forests.

The field work of the current study was performed in three locations throughout the Mongolian Khentey Mountain region: *Khonin Nuga* (West Khentey), *Bogd Khan Uul* (South Khentey) and *Mongonmorit* (East Khentey).

2.1.1. Khonin Nuga

The ecological research station *Khonin Nuga* (49°05.228' N, 107°17.442'E) is situated in the 2012 expansion of the *Strictly Protected Area Khan Khentij* in Selenge Aimag at Eroo River. The elevation of that area varies between 900 m and up to 1600 m. Dulamsuren et al. [1] provided a detailed characterisation of vegetation types in that region. According to satellite data [16], our sampling plots in the West Khentey received 282 mm precipitation per year on average, while the value increased with higher altitude and a location closer to the central parts of the Mountain ridge.

In spring 2009 heavy fires destroyed huge forest areas in the vicinity of the station and left a mosaic of highly and lesser-damaged forests interspersed with unburnt areas.

The sampling plots of our study were located throughout the Eroo River valley and the surrounding mountains. Additionally some samples were taken from plots close to creek *Barchuluut Gol*,

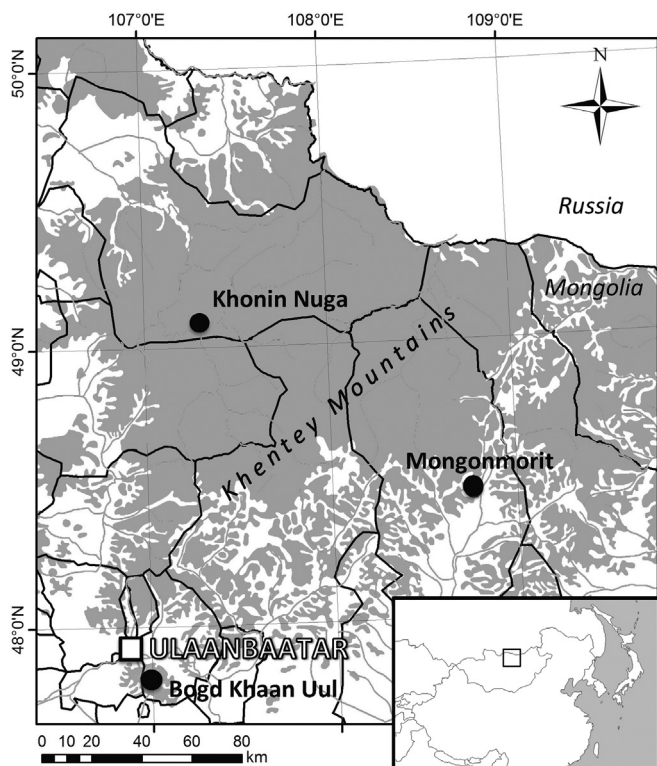


Fig. 1. Location of the Khentey Mountains in northern Mongolia. The three research areas are marked with black dots. Mainly forested regions are grey. Map: S. Tuvshintugs (modified).

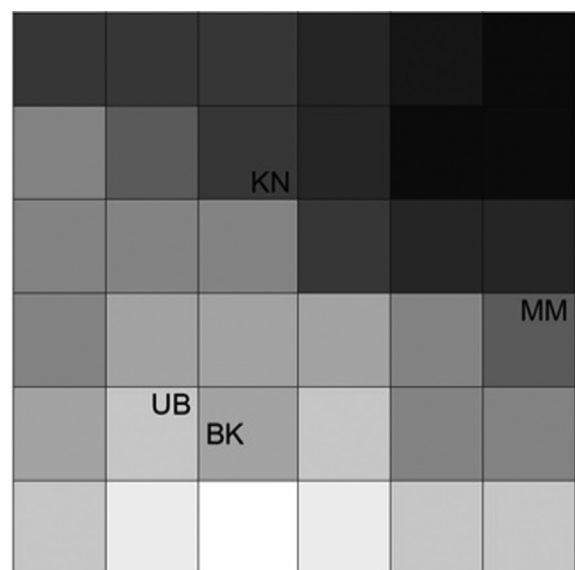


Fig. 2. Rainfall in Khentey Mountains according to satellite data [16]. White (minimum) = 217.4 mm, Black (maximum) = 365.9 mm. The letters give the location of the Mongolian capital Ulaanbaatar (UB) and our plots: Bogd Khan Uul (BK), Khonin Nuga (KN) and Mongonmorit (MM).

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